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INTRODUCTION

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Certain publications abstracted in *STAR* are given analytic treatment, with citations and abstracts of daughter items following immediately after the parent document. When the subject content of a daughter differs from that of its parent, a cross-reference citation is printed at the end of the category to which the daughter would normally have been assigned.

Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

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By arrangement between NASA and the American Institute of Aeronautics and Astronautics, the AIAA publication *International Aerospace Abstracts (IAA)* provides parallel coverage of scientific and trade journals, books, and conference papers in the same subject areas as *STAR*. *STAR* and *IAA* are categorized and abstracted in basically identical ways, and documents in both are indexed by terms from the *NASA Thesaurus*. Both journals appear twice monthly, *IAA* being issued on the 1st and 15th of each month.

IAA is available on subscription from the American Institute of Aeronautics and Astronautics, Technical Information Service, 750 Third Avenue, New York, NY 10017, at the following annual rates:

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Scientific and technical reports produced by NASA and its contractors and grantees, or in conjunction with other Government agencies, and other selected documents released by NASA are identified by an asterisk (*) following the accession numbers (e.g., N72-10748*). Prior to their announcement in *STAR*, these NASA publications are assigned a specific NASA report number, which is shown on the last line of the *STAR* citation. The nature of NASA publications is specified by the report number series, identified by a prefix to the report number: TR-R, TN-D, TM-X, TT-F, CR, or SP. These series refer respectively to NASA Technical Reports, which contain significant and complete contributions to scientific and technical knowledge; Technical Notes, reports of similar quality by lesser scope; Technical Memorandums, reports containing preliminary data or of specialized utility; Technical Translations, information published in a foreign language and considered to merit NASA distribution in English; Contractor Reports, information generated under NASA-sponsored contracts, grants, or interagency agreements; and Special Publications, which include conference proceedings, monographs, data compilations, sourcebooks, special bibliographies, and other publications derived from or of value to NASA activities. Reports in these series that are printed by NASA are often referred to as "low numbered" or "low series" publications, because the report number is always below 50,000 (8,000 for Technical Translations). Some TM-X and CR reports are numbered above 50,000. These, and TT-F translations above 8,000, are referred to as "high-numbered" or "high series" publications, and are generally available only in microfiche[1] or facsimile reproductions.

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tions of NASA documents for public reference;

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The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA Thesaurus* should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set. The first two volumes of this Thesaurus, consisting of the alphabetical listing of subject terms (A–Z), have been superseded by the following single-volume publication: *NASA Thesaurus Alphabetical Update* (September 1971) (NASA SP-7040), available from NTIS for $6.00. (Volume III of the Preliminary Edition consists of the following ancillary aids to vocabulary selection: heirarchical display of index terms, category term listing, permuted index, and a listing of postable terms only.)

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Denver, Colorado 80225

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft 1825
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 1831
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 1833
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 1836
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 1838
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 1840
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

08 Computers 1845
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 1848
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 1851
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 1854
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 1856
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 1863
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 1884
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 1889
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

16 Masers 1892
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

17 Materials, Metallic 1894
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

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18 Materials, Nonmetallic 1900
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 1904
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 1908
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 1911
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 1913
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

23 Physics, General 1916
Includes acoustics, Cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation.

24 Physics, Atomic, Molecular, and Nuclear 1918
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

25 Physics, Plasma 1920
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

26 Physics, Solid-State 1923
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

27 Propellants 1928
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

28 Propulsion Systems 1932
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

29 Space Radiation 1938
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 1940
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 1947
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 1949
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 1953
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

34 General 1957
Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

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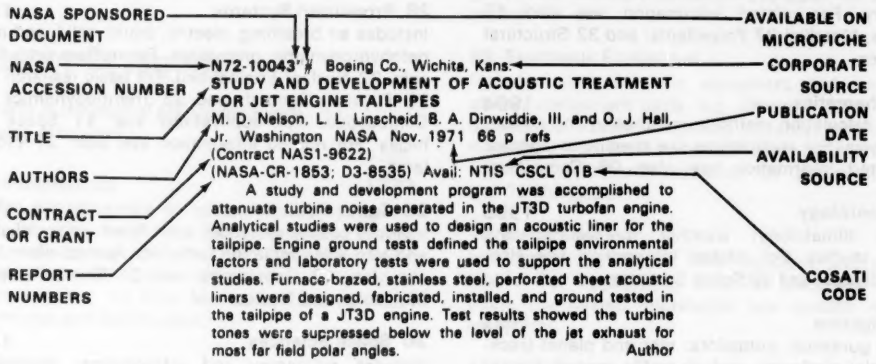
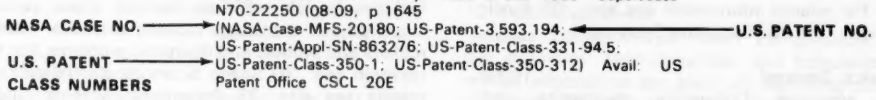


N72-10043*# Boeing Co., Wichita, Kans.
STUDY AND DEVELOPMENT OF ACOUSTIC TREATMENT FOR JET ENGINE TAILPIPES
M. D. Nelson, L. L. Linscheid, B. A. Dinwiddie, III, and O. J. Hall, Jr. Washington NASA Nov. 1971 66 p refs
(Contract NAS1-9622)
(NASA-CR-1853; D3-8535) Avail: NTIS CSCL 01B

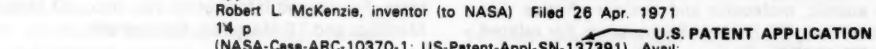
A study and development program was accomplished to attenuate turbine noise generated in the JT3D turbofan engine. Analytical studies were used to design an acoustic liner for the tailpipe. Engine ground tests defined the tailpipe environmental factors and laboratory tests were used to support the analytical studies. Furnace-brazed, stainless steel, perforated sheet acoustic liners were designed, fabricated, installed, and ground tested in the tailpipe of a JT3D engine. Test results showed the turbine tones were suppressed below the level of the jet exhaust for most far field polar angles. Author

PATENT CITATION



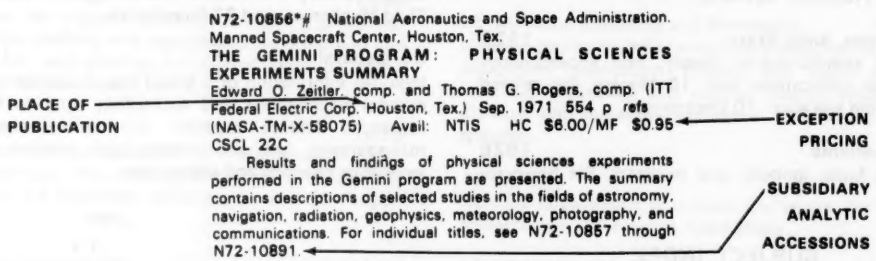
N72-12440* Auburn Research Foundation, Inc., Ala.
LASER COOLANT AND ULTRAVIOLET FILTER Patent
John R. Rasquin and Fred R. McDevitt, inventors (to NASA)
Issued 13 Jul. 1971 14 p Filed 2 Oct. 1969 Supersedes N70-22250 (08-09, p 1645
(NASA-Case-MFS-20180; US-Patent-3,593,194; US-Patent-Appl-SN-863276; US-Patent-Class-331-94.5; US-Patent-Class-350-1; US-Patent-Class-350-312) Avail: US Patent Office CSCL 20E

PATENT APPLICATION CITATION



N72-10432*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIATOMIC INFRARED GASDYNAMIC LASER Patent Application
Robert L. McKenzie, inventor (to NASA) Filed 26 Apr. 1971 14 p
(NASA-Case-ARC-10370-1; US-Patent-Appl-SN-137391) Avail: NTIS CSCL 20E

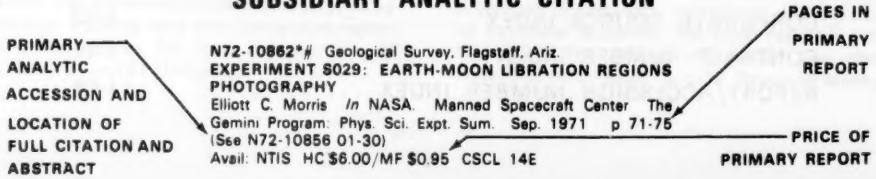
PRIMARY ANALYTIC CITATION AND ABSTRACT



N72-10856*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE GEMINI PROGRAM: PHYSICAL SCIENCES EXPERIMENTS SUMMARY
Edward O. Zeitler, comp. and Thomas G. Rogers, comp. (ITT Federal Electric Corp., Houston, Tex.) Sep. 1971 554 p refs
(NASA-TM-X-58075) Avail: NTIS HC $6.00/MF $0.95 CSCL 22C

Results and findings of physical sciences experiments performed in the Gemini program are presented. The summary contains descriptions of selected studies in the fields of astronomy, navigation, radiation, geophysics, meteorology, photography, and communications. For individual titles, see N72-10857 through N72-10891.

SUBSIDIARY ANALYTIC CITATION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N72-10862*# Geological Survey, Flagstaff, Ariz.
EXPERIMENT S029: EARTH-MOON LIBRATION REGIONS PHOTOGRAPHY
Elliott C. Morris *In* NASA. Manned Spacecraft Center The Gemini Program: Phys. Sci. Expt. Sum. Sep. 1971 p 71-75
(See N72-10856 01-30)
Avail: NTIS HC $6.00/MF $0.95 CSCL 14E

VOLUME 10 NUMBER 14 / JULY 23, 1972

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N72-22991 Georgia Inst. of Tech., Atlanta.
AN INVESTIGATION OF NEAR WAKE EFFECTS IN AIRFOIL DYNAMIC STALL Ph.D. Thesis
Roy Mac Scruggs 1971 203 p
Avail: Univ. Microfilms Order No. 71-20365

A combined analytical and experimental investigation is performed to evaluate near wake effects on airfoil loading in dynamic stall and to study the wake structure resulting from oscillatory motion of a stalled airfoil. A central objective of the work is to establish the importance of wake Strouhal resonance as it relates to the time dependent loading of the airfoil and the establishment of wake coherency. An analytical model is developed using a flat plate approximation and based on the assumption of circulation preserving flow, after due allowance for loss of bound circulation in steady or mean stall. The model demonstrates, through abrupt release of discrete vortices from leading and trailing edges, the type of behavior observed experimentally for the time dependent loading of a dynamically stalled airfoil. It further indicates that decreasing vortex propagation velocity, with all other parameters fixed, tends to be destabilizing to the airfoil pitch motion. Dissert. Abstr.

N72-22992 Illinois Univ., Urbana.
THEORETICAL DETERMINATION OF THE PRESSURE DISTRIBUTION ON A LIFTING, SUBSONIC DELTA WING OF ARBITRARY ASPECT RATIO Ph.D. Thesis
Carl Eugene Swain 1971 116 p
Avail: Univ. Microfilms Order No. 71-21245

The subsonic, plane delta wing problem is solved by use of linearized lifting surface theory. The pressure distribution on the wing surface is expressed as a particular series of Tchebycheff polynomials of the first and second kinds whose arguments are functions of both the spanwise and the chordwise variables. The tangential flow boundary condition, which must be imposed upon the lifting-surface integral equation, is satisfied by use of Flax's variational principle. The use of this variational principle allows the unknown coefficients in the pressure distribution series to be determined from a set of linear algebraic equations. Dissert. Abstr.

N72-22993*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF TRANSIENT WINDS ON THE FLOW QUALITY OF AN OPEN-CIRCUIT WIND-TUNNEL MODEL
Douglas C. Breunlin and Noel B. Sargent Washington Apr. 1972 24 p refs
(NASA-TM-X-2538; E-6773) Avail: NTIS HC $3.00 CSCL 01A

The effect of a transient wind on the test-section flow quality of an open-circuit wind tunnel was investigated experimentally. The investigation was restricted to transient wind effects associated with the inlet. A small open-circuit wind tunnel was placed outside in the real wind environment. Test-section speed and angularity as well as wind speed and direction was measured by high-response instrumentation. The inlet configuration was varied with a set of screens, a removable honeycomb, and a removable inlet lip. Acceptable flow was obtained at all wind angles and for wind- to test-section-velocity ratios up to 0.4 with an inlet configuration having five screens, a honeycomb, and a lip. With inlet configurations sensitive to winds, a transient wind parallel to the tunnel axis produced local fluctuations in test-section speed and angularity; however, oscillation of the average test-section speed was not evident. The effect of wind direction was negligible up to wind angles of 45 deg relative to the tunnel axis. At larger wind angles, flow distortions occurred primarily on the windward side of the test section. Author

N72-22994*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF CASING BOUNDARY-LAYER REMOVAL ON NOISE OF A TURBOFAN ROTOR
Arthur W. Goldstein, Frederick W. Glaser, and James W. Coates Washington Apr. 1972 40 p refs
(NASA-TN-D-6763; E-6727) Avail: NTIS HC $3.00 CSCL 01A

The effect of casing boundary-layer removal on noise produced by a turbofan rotor was measured. The outlet guide vanes were removed for these tests. A comparison was made between the noise measurements when the boundary layer was bled off and under zero bleed conditions. When the boundary layer was removed, overall sound pressure level was reduced 2 dB with moderate blade loading and 3 dB with heavier blade loading. An analysis of the changes in the spectral density with bleed is presented. Author

N72-22995*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NONPLANAR METHOD FOR PREDICTING INCOMPRESSIBLE AERODYNAMIC COEFFICIENTS OF RECTANGULAR WINGS WITH CIRCULAR-ARC CAMBER Ph.D. Thesis - Virginia Polytechnic Institute
John Everett Lamar Dec. 1971 94 p refs
(NASA-TM-X-67791) Avail: NTIS HC $6.75 CSCL 01A

The development of a nonplanar lifting surface method having a continuous distribution of singularities and satisfying the tangent flow boundary condition on the mean camber surface is given. The method predicts some incompressible

longitudinal aerodynamic coefficients of rectangular wings which have circular-arc camber. The solution method is of the integral-equation type and the resulting surface integrals are evaluated by either using numerical or analytical techniques, as are appropriate. Applications are made and the results compared with those from an exact two-dimensional circular-arc camber solution, a three-dimensional flat-wing solution which represents the camber by a projected slope onto the flat surface, and a flat-wing experiment. From these comparisons, the present method is found to predict well the flat-wing experiment and limiting values, in addition to the center of pressure variation at an angle of attack of zero for any camber. For wings having camber ratios larger than about 1.25% and moderate to high aspect ratios, the results deterioriate due to the inadequacy of lifting pressure modes employed. Author

N72-22996# Sandia Labs., Albuquerque, N.Mex.
NONLINEAR MOTION OF AN ASYMMETRIC BODY WITH VARIABLE ROLL RATE
Ali Hasan Nayfeh (Va. Polytechnic Inst.) and William S. Saric Feb. 1972 50 p refs Sponsored by AEC
(SC-RR-720051) Avail: NTIS

The nonlinear analysis is performed for the motion of a rolling reentry vehicle for the case of variable roll rate, dynamic pressure, and stability derivatives. The roll degree of freedom is coupled with the pitch and yaw degree of freedom instead of assuming a priori the variation of the roll rate. Each of the restoring, damping, lag, Magnus, and induced moments is assumed to be a cubic function of the angle of attack with variable coefficients. The generalized version of the method of multiple scales is used to derive equations for the roll rate and the amplitudes and phases of the oscillatory modes of the angle of attack near and away from roll resonance. The analytical solution is found to be in good agreement with the numerical solution of the full problem. Author

N72-22997# Boeing Co., Renton, Wash. Commercial Airplane Group.
STUDY COVERING CALCULATIONS AND ANALYSIS OF SONIC BOOM DURING OPERATIONAL MANEUVERS. VOLUME 3: DESCRIPTION OF COMPUTER PROGRAM, SONIC BOOM PROPAGATION IN A STRATIFIED ATMOSPHERE, AND ESTIMATION OF LIMITATION NEAR CAUSTICS Final Report, Apr. 1970 - Feb. 1971
G. T. Haglund and D. L. Olson Feb. 1971 294 p refs
(Contract DOT-FA70WA-2315)
(AD-735297; D6-A-12108-3-Vol-3; FAA-EQ-71-2-Vol-2) Avail: NTIS CSCL 01/2

The methods and results of the study of the effects of operational SST maneuvers on sonic boom are contained in three volumes. Volume III describes the computer program, sonic boom propagation in a stratified atmosphere, written in FORTRAN IV for processing on an IBM 7090 or CDC 6600 and plotting on a CalComp digital incremental plotter. It provides the capability to calculate sonic boom pressure signatures generated by arbitrary maneuvering airplanes in horizontally stratified atmospheres with wind. Author (GRA)

N72-22998# Carnegie-Mellon Univ., Pittsburgh, Pa. Transportation Research Inst.
TUBE VEHICLE SYSTEMS: AERODYNAMIC CHARACTERISTICS; VOLUME 3 Final Report
S. William Gouse, Jr. and Ezzat I. Wali Oct. 1971 157 p refs
(Contracts DOT-UT-237; DOT-FR-00007)
(PB-204933; UMTA-URT-5(70)-71-3-Vol-3) Avail: NTIS HC $3.00 CSCL 15E

The results are presented of an investigation of the dependence of the drag forces exerted on vehicles having the shape of a cylinder with streamlined nose and conical tail, moving coaxially with uniform linear relatively low velocity in solid wall tubes of finite length, on the velocity of approach ratio, defined as the ratio of the relative velocity of the induced fluid pushed ahead of the vehicle to the absolute velocity of the vehicle. A theoretical analysis was carried out by dividing the fluid flow about the vehicle into two regions; i.e., near and far flow regions. The flow regions were matched together by the condition that the pressures are continuous at the boundaries. An experimental investigation was conducted employing a vertical acrylic test tube, 25 feet high and 1.732 inch inside diameter. The tube was provided with water flow of different negative and positive pressure gradients. Vehicle drop tests were then conducted. GRA

N72-22999# Boeing Co., Philadelphia, Pa. Vertol Div.
WIND TUNNEL TEST OF THE CONVERSION PROCESS OF A FOLDING TILT ROTOR AIRCRAFT USING A SEMISPAN UNPOWERED MODEL VOLUME 4, PART 1: ANALYSIS AND RESULTS Final Report
John Magee and Robert B. Taylor Wright-Patterson AFB, Ohio AFFDL Aug. 1971 140 p refs
(Contract F33615-69-C-1577)
(AD-735632; D213-10000-4-Vol-4-Pt-1; AFFDL-TR-71-62-Vol-4-Rt-1) Avail: NTIS CSCL 01/3

Wind tunnel test data obtained with a 33.75 inch diameter nonarticulated folding tilt rotor mounted on a semispan wing show the effects of collective pitch schedule variations on transient lift, drag, and pitching moment of the aircraft. Blade loads data presented show that loads do not limit the conversion process. The model was configured with prop/rotor blades which had an in-plane natural frequency of less than 1.0/rev. The testing included study of the aerodynamics and dynamics of rotor spin-up, spin-down, stopping, and steady windmilling. Correlation with predictions of transient aerodynamic performance static derivatives of the prop/rotor, and blade loads are included. Author (GRA)

N72-23000# Boeing Co., Philadelphia, Pa. Vertol Div.
WIND TUNNEL TEST OF A POWERED TILT-ROTOR DYNAMIC MODEL ON A SIMULATED FREE FLIGHT SUSPENSION SYSTEM, VOLUME 6 Final Report, Jan. - Jul. 1971
John E. Tomassoni, Robert B. Taylor, Leon N. Delarm, and Edward B. Schagrin Wright-Patterson AFB, Ohio AFFDL Oct. 1971 210 p refs
(Contract F33615-69-C-1577)
(AD-735633; D213-10000-6-Vol-6; AFFDL-TR-71-62-Vol-6) Avail: NTIS CSCL 01/3

The report presents the results of a wind tunnel test on a powered dynamic model of the Boeing M-160 tilt rotor aircraft with 5.5 foot diameter rotors. The model was tested in the Boeing V/STOL 20 x 20 foot wind tunnel during January - February 1971 and was supported to simulate free flight conditions with mount frequencies much lower than the dynamic aircraft frequencies. Blade loads, wing loads, flying qualities and skittishness in ground effect data were obtained. Author (GRA)

N72-23001# ARO, Inc., Arnold Air Force Station, Tenn.
DIMENSIONAL LAMINAR BOUNDARY-LAYER ANALYSIS OF UPWASH PATTERNS AND ENTRAINED VORTEX FORMATION ON SHARP CONES AT ANGLE OF ATTACK Final Report, Jul. 1970 - May 1971
John C. Adams, Jr. AEDC Dec. 1971 62 p refs
(Contract F40600-72-C-0003; Proj. ARO)
(AD-736880; ARO-VKF-TR-71-141; AEDC-TR-71-215) Avail: NTIS CSCL 01/3

Application of three-dimensional inviscid and viscous (laminar boundary layer) analyses for cold wall hypersonic flows over sharp cones at incidence is presented relative to experimental data, showing surface upwash angles and entrained vortex formation leading to crossflow-induced boundary-layer transition. Three-dimensional neutral inviscid stability theory for stationary disturbances is used to calculate the angular orientation of the entrained vortices in the boundary layer while a maximum crossflow Reynolds number concept is applied for correlation of the onset to vortex formation due to crossflow instability. GRA

N72-23002# Douglas Aircraft Co., Inc., Long Beach, Calif.
INVESTIGATION OF AERODYNAMIC ANALYSIS PROBLEMS IN TRANSONIC MANEUVERING, VOLUME 1 Final Report, Jun. 1970 - Aug. 1971
Arvel E. Gentry and Wayne R. Oliver Sep. 1971 264 p refs
(Contract N00014-70-C-0400; NR Proj. 212-199)
(AD-737293; MDC-J5264-01-Vol-1) Avail: NTIS CSCL 20/4

This report describes the results of a study into the general problems of the aerodynamic analysis of airfoils and wings at transonic flight conditions. The basic guideline of this study was to assess, analyze and interpret the various methods available and to explore their further development where possible. The general aspects of the transonic maneuvering problem were reviewed. Particular emphasis was placed on methods for the analysis of airfoils leading to buffet onset prediction. This program includes a potential flow analysis, supercritical pressure calculations, and boundary layer calculation using either a finite-difference method or an integral method. Methods available for predicting pressures on three-dimensional wings are also compared. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N72-23003 Delaware Univ., Newark.
AN EXPERIMENTAL STUDY OF SUBSONIC JET NOISE AND A METHOD FOR LOW FREQUENCY REDUCTION Ph.D. Thesis.
Walter Zane Collings 1970 333 p
Avail: Univ. Microfilms Order No. 71-17932

The fundamentals of jet noise generation and suppression are reviewed. The noise field of a one inch diameter subsonic air jet was investigated and a method for low frequency reduction evaluated. The Mach number range was from 0.55 to 1.0. The wide-band noise measurements cover the frequency range from 250 Hz to 18,000 Hz and noise spectra were analyzed in 1/3-octave bands. The airflow system and noise measuring system are described. The errors associated with taking measurements within an enclosed room are considered, as well as the method used to establish the approximate field conditions. For the simple jet, the directionality of the wide-band levels and spectrum levels are shown. The power law dependence of both wide-band and spectrum sound pressures on velocity is determined. Comparisons are made with theory and previous work. The measurements confirm the main points of the theory, namely, convected quadrupole radiation. Dissert. Abstr.

N72-23004 Cornell Univ., Ithaca, N.Y.
THE EFFECT OF ATMOSPHERIC INHOMOGENEITIES ON THE SONIC BOOM Ph.D. Thesis
Kenneth Jay Plotkin 1971 200 p
Avail: Univ. Microfilms Order No. 71-17122

The effect of atmospheric inhomogeneities on the sonic boom and other weak waves is investigated. First, the propagation of sonic booms through a quiescent, smoothly varying atmosphere is examined. Geometric acoustics (analogous to geometrical optics) is used to extend the linearized flow (acoustic) solution from near the aircraft to distances far enough away so that atmospheric variations must be taken into account. The equations of geometric acoustics are derived, and ray paths are calculated for a horizontally stratified atmosphere. This acoustic solution is then corrected by the inclusion of lowest order nonlinear wave steepening, which gives the classical N-wave signature in the far field. A simplified method for calculating signatures at the ground directly under the flight track, without the need for a computer for each case, is presented. Dissert. Abstr.

N72-23005 Purdue Univ., Lafayette, Ind.
A FEASIBILITY STUDY OF ACTIVE CONTROL TO IMPROVE THE PERFORMANCE AND VIBRATION CHARACTERISTICS OF ROTOR BLADES Ph.D. Thesis
Donald Thomas Gordon 1971 181 p
Avail: Univ. Microfilms Order No. 71-20465

Improvements in the dynamic and aerodynamic performance of helicopter rotor blades are investigated. The major portion of the research involves the development of a digital computer simulation for the rotor blade. The simulation utilizes a discrete mass model of a rotating, cantilevered blade with generalized physical properties. This analysis is limited to coupled flap bending/torsion motion. External effects can be introduced as forces, accelerations, velocities, and displacements at almost any point on the blade. Time step integration allows analysis of transient effects, steady state motion, and instabilities. A set of trailing edge flaps along the entire length of the blade is used as a lift augmentation device. The final portion of the analysis is concerned with reducing the undesirable dynamic characteristics of the blade. Dissert. Abstr.

N72-23006 Illinois Univ., Urbana.
RESPONSE OF FLIGHT VEHICLES TO NONSTATIONARY RANDOM ATMOSPHERIC TURBULENCE Ph.D. Thesis
Larry James Howell 1971 136 p
Avail: Univ. Microfilms Order No. 71-21142

Retaining the assumptions generally imposed on a turbulence field, those of isotropy and of the frozen pattern of the gust velocity with respect to a moving vehicle, the statistical description of the gust field to one with a nonstationary random velocity is presented. Three different methods which may be used in the general nonstationary analysis are described. The evolutionary spectral method to compute response statistics of a rigid single-degree-of-freedom aircraft subjected to a uniformly modulated nonstationary random process is employed. In sharp contrast to the conventional treatment of the gust velocity as a stationary random process, response statistics which are time varying have been obtained. Dissert. Abstr.

N72-23007 Stanford Univ., Calif.
OPTIMAL THREE DIMENSIONAL TURNING MANEUVERS FOR SUPERSONIC AIRCRAFT Ph.D. Thesis
John Karl Hedrick 1971 163 p
Avail: Univ. Microfilms Order No. 71-19699

Using the energy-state approximation, thrust, bank angle, and altitude histories have been determined for three-dimensional turning maneuvers. In general, the change in heading angle and the initial and final energies are specified. The angle-of-attack is constrained to be less than the stall angle of the aircraft, and the thrust is constrained to be non-negative and less than the maximum attainable thrust, which is a function of Mach number and altitude. Numerical results are presented for a realistic supersonic aircraft. Control histories, state histories, and feedback control charts are presented for (1) constant altitude minimum time turns, (2) three-dimensional gliding turns, (3) three-dimensional minimum time turns, and (4) three-dimensional minimum fuel turns. Dissert. Abstr.

N72-23008# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
REPORT ON THE DGLR-SYMPOSIUM ON DESIGN PROBLEMS OF V/STOL PROPELLER AND ROTORS
Dec. 1971 309 p refs Partly in GERMAN; partly in ENGLISH; ENGLISH summary Conf. held in Stuttgart, 6 May 1971
(DLR-Mitt-71-18) Avail: NTIS HC $17.50; ZLDI Munich: 64.90 DM

Aerodynamic design aspects of V/STOL and STOL propellers and rotors are discussed. Considered are cyclic pitch control of tilt wing aircrafts, recovery rotor systems, and adaptation of

VTOL propellers to static aerodynamic situations. For individual titles, see N72-23009 through N72-23016.

N72-23009# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
MODERN TECHNOLOGY IN THE DEVELOPMENT OF V/STOL PROPELLERS AND ROTORS [MODERNE TECHNOLOGIEN IN DER ENTWICKLUNG VON V/STOL-PROPELLERN UND ROTOREN]
H. Huber and H. Weiss *In* DGLR Rept. on the DGLR-Symp. on Design Probl. of V/STOL Propellers and Rotors Dec. 1971 p 7-46 refs In GERMAN (See N72-23008 14-02)
(DGLR-71-016) Avail: NTIS HC $17.50; ZLDI Munich: 64.90 DM

A systematic development of flight mechanical aspects is used to obtain technological construction and design specifications for V/STOL propellers and rotors. Considered are aerodynamic parameters, expected loads, frequency and stability, and typical maneuver dynamics. Emphasis is placed on the peculiarities of cyclic pitch propellers and the application of modern fiber technology to laminar propeller construction methods.
Transl. by G.G.

N72-23010# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Munich (West Germany).
PROBLEMS IN AERODYNAMIC LAYOUTS OF V/STOL PROPELLERS [PROBLEME DER AERODYNAMISCHEN AUSLEGUNG VON V/STOL-PROPELLERN]
P. Ebeling *In* DGLR Rept. on the DGLR-Symp. on Design Probl. of V/STOL Propellers and Rotors Dec. 1971 p 47-83 refs In GERMAN (See N72-23008 14-02)
(DGLR-71-017) Avail: NTIS HC $17.50; ZLDI Munich: 64.90 DM

Numerical optimization methods for aerodynamic V/STOL propeller design analyses are evaluated. It is shown that the application of these methods requires exact formulations of the optimization goal and of important parameters. Precise numerical prediction of propeller performance on ground is important because it affects working load differences. Transonic profile properties influence markedly VTOL propeller design for very high flight speeds.
Transl. by G.G.

N72-23011# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
MEETING PROPULSION NEEDS OF FUTURE HIGH PERFORMANCE V/STOL c28
A. Jackson *In* DGLR Rept. on the DGLR-Symp. on Design Probl. of V/STOL Propellers and Rotors Dec. 1971 p 85-133 (See N72-23008 14-02)
(DGLR-71-018) Avail: NTIS HC $17.50; ZLDI Munich: 64.90 DM

Several STOL and V/STOL aircraft systems are studied for future requirements and evolutionary propulsion design approaches with emphasis on environmental pollution and noise reduction. Advanced technology transports considered are a high speed STOL with thrust requirements intermediate between propellers and fans, and a quiet STOL. Initial noise tests on model fans confirm the acoustic benefits of low fan tip speed and low fan exhaust velocity. STOL aircraft system studies confirm that the prop-fan propulsion system offers the best solution for future STOL requirements.
Transl. by G.G.

N72-23012# Boeing Co., Philadelphia, Pa. Vertol Div.
CYCLIC PITCH CONTROL ON A V/STOL TILT-WING AIRCRAFT
H. Rosenstein and C. E. Kolesar *In* DGLR Rept. on the DGLR-Symp. on Design Probl. of V/STOL Propellers and Rotors Dec. 1971 p 135-190 refs (See N72-23008 14-02)
(DGLR-71-019) Avail: NTIS HC $17.50; ZLDI Munich: 64.90 DM

Results are presented of a model wind tunnel test program that was directed toward investigating the use of cyclic pitch propellers as the low speed longitudinal control system of a V/STOL tilt wing aircraft. The pitch control effectiveness of this system through transitional flight and in ground effect is discussed and the power increase associated with its use is shown. Data are presented to illustrate the small influence that cyclic pitch inputs have on longitudinal stability and lateral/directional stability. Cyclic-pitch control coupled with stabilizer control is discussed along with crosscoupling of cyclic pitch with the wing surface controls for roll/yaw control.
Author

N72-23013# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
SOME SELECTED PROBLEMS OF ROTOR SUPPORTED RECOVERY SYSTEMS. PART 1: DESIGN [EINIGE AUSGEWAEHLTE PROBLEME BEI ROTORGESTUETZTEN BERGESYSTEMEN. TEIL 1: ENTWURF]
H. Stoecklin and H. Zimmer *In* DGLR Rept. on the DGLR-Symp. on Design Probl. of V/STOL Propellers and Rotors Dec. 1971 p 191-226 refs In GERMAN (See N72-23008 14-02)
(DGLR-71-020-Pt-1) Avail: NTIS HC $17.50; ZLDI Munich: 64.90 DM

The design and aerodynamic characteristics of an unmanned rotary recovery device is reported. The device functions as rudder during flight and controls gear, roll, and angle steering mechanisms. During the transition phase to rotor flight, hydraulic agitation tilts rotor blades and unfolds telescopic blade extensions so that the rudder mechanism acts as an autorotating propeller.
Transl. by G.G.

N72-23014# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
SOME SELECTED PROBLEMS OF ROTOR SUPPORTED RECOVERY SYSTEMS. PART 2: AERODYNAMICS OF ROTORS WITH AXIAL DESCENDING FLOW [EINIGE AUSGEWAEHLTE PROBLEME BEI ROTORGESTUETZTEN BERGESYSTEMEN. TEIL 2: AERODYNAMIK DES AXIAL ANGESTROEMTEN ABSTEIGENDEN ROTORS]
H. Zimmer *In* DGLR Rept. on the DGLR-Symp. on Design Probl. of V/STOL Propellers and Rotors Dec. 1971 p 227-244 In GERMAN (See N72-23008 14-02)
(DGLR-71-020-Pt-2) Avail: NTIS HC $17.50; ZLDI Munich: 64.90 DM

An impulse wing-blade theory is used to calculate the aerodynamics of a rotary recovery system for flying bodies during transition from horizontal flight to gliding flight. Calculated are aerodynamic force distribution and the combined values of thrust and momentum for an axial descending rotor flow.
Transl. by G.G.

N72-23015# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
A REVIEW OF STATIC THRUST AND CYCLIC PITCH TECHNOLOGY FOR V/STOL PROPELLERS
R. J. Hirt *In* DGLR Rept. on the DGLR-Symp. on Design Probl. of V/STOL Propellers and Rotors Dec. 1971 p 245-284 (See N72-23008 14-02)
(DGLR-71-021) Avail: NTIS HC $17.50; ZLDI Munich: 64.90 DM

A brief summary of the status of technology from the standpoint of propeller performance, hover/low speed control and propeller-wing aerodynamics interaction effects is presented. Data are presented that illustrate the improvements that have been made in static efficiency. The penalties associated with the use of cyclic pitch propellers are also presented. Control powers are briefly discussed because of the relationship of longitudinal control and the cyclic pitch propeller.
Author

N72-23016# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Munich (West Germany).
METHODS FOR DEVELOPING THE ADAPTABILITY OF VTOL PROPELLERS [METHODEN ZUR ENTWICKLUNG

DER ANPASSUNGSFAEHIGKEIT VON VTOL-PROPELLERN]
R. Huber and J. Wimbauer *In* DGLR Rept. on the DGLR-Symp. on Design Probl. of V/STOL Propellers and Rotors Dec. 1971 p 287-306 refs In GERMAN (See N72-23008 14-02)
(DGLR-71-023) Avail: NTIS HC $17.50; ZLDI Munich: 64.90 DM

The cost effectiveness is discussed of a VTOL propeller with blow down edges that increases hovering ability and compensates for output loss caused by noise reduction through decreased propeller Mach number. Transl. by G.G.

N72-23017*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TERMINAL-AREA GUIDANCE ALGORITHMS FOR AUTOMATED AIR-TRAFFIC CONTROL
Heinz Erzberger and Homer Q. Lee Washington Apr. 1972 83 p refs
(NASA-TN-D-6773; A-3741) Avail: NTIS HC $3.00 CSCL 17G

Terminal-area guidance problems are solved in the form of computer-oriented algorithms. A flyable, three-dimensional trajectory is constructed that begins at the current aircraft position, heading, speed, and altitude, and that terminates at a prescribed position, heading, speed, altitude, and time. The terminal position is a waypoint and the terminal time is the assigned landing slot. The algorithms developed are applicable to all possible combinations of initial and final conditiions, and thus can be used in a closed-loop feedback law. Author

N72-23018# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
FOUR INTRODUCTORY LECTURES ON AERODYNAMIC NOISE THEORY
H. V. Fuchs and A. Michalke 11 Oct. 1971 113 p refs Presented at Short Course on Aircraft Noise, Tullahoma, Tenn., 15-19 Mar. 1971
(DLR-Mitt-71-20) Avail: NTIS HC $7.75; DFVLR Porz-Wahn: 27.90 DM

An introduction is presented to the theory of aerodynamic sound generation. A general integral solution to the inhomogeneous wave equation is discussed including the effect of boundaries. Lighthill's acoustic analogy is described in terms of equivalent simple sources. Certain approximations are given for the far-field sound intensity. Dimensional analysis is performed neglecting the effect of retarded times. Jet noise is treated on the assumption of a specific structure of the turbulence convected by the flow. Some approaches alternative to Lighthill's theory are indicated. Spectral methods in jet noise theory are treated. Individual frequency components of the sound intensity are derived by means of a Fourier transform with respect to time. Their directivities are discussed on the basis of two differing methods. For individual titles, see N72-23019 through N72-23022.

N72-23019# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
AERODYNAMIC NOISE THEORY 1 (GENERAL ASPECTS)
H. V. Fuchs *In its* Four Introductory Lectures on Aerodyn. Noise Theory 11 Oct. 1971 p 7-31 refs (See N72-23018 14-02)
Avail: NTIS HC $7.75; DFVRL Porz Wahn: 27.90 DM

A numerical analysis of flow noise theory is presented. The derivation of the governing equations is described in general terms while specifications feasible for special flow configurations and boundaries are treated less comprehensively. Consideration is given to the source element as an equivalent monopole emitter, an equivalent dipole emitter, and an equivalent quadrupole emitter. Mathematical models are included to support the theoretical concepts. Author

N72-23020# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
AERODYNAMIC NOISE THEORY 2 (APPROXIMATE PROCEDURES)
H. V. Fuchs *In its* Four Introductory Lectures on Aerodyn. Noise Theory 11 Oct. 1971 p 32-50 refs (See N72-23018 14-02)
Avail: NTIS HC $7.75; DFVRL Porz-Wahn: 27.90 DM

A theoretical treatment of the properties of radiated far-field sound is presented. Subjects discussed are: (1) simplification of the radiated far-field, (2) near and far-field of monopole-type sources, dipole-type sources, and quadrupole-type sources, (3) intensity of radiated sound, (4) idealized model of turbulence structure, and (5) dimensional analysis of aerodynamic sound production. Mathematical models are included to support the theoretical concepts. Author

N72-23021# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
AERODYNAMIC NOISE THEORY 3 (JET NOISE)
H. V. Fuchs *In its* Four Introductory Lectures on Aerodyn. Noise Theory 11 Oct. 1971 p 51-90 refs (See N72-23018 14-02)
Avail: NTIS HC $7.75; DFVLR Porz-Wahn: 27.90 DM

The characteristics of free turbulence as a source of aerodynamic noise are discussed. Application to a topical problem, that of the noise from jets, is described. Modifications to flow theory, which are required for flows where turbulence is convected at high speeds, are examined. Emphasis is placed on the acoustic power radiated by a jet, its frequency, and directivity. Author

N72-23022# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfanrt, Berlin (West Germany). Inst. fuer Turbulenzforschung.
SPECTRAL METHODS IN JET NOISE THEORY
A. Michalke *In its* Four Introductory Lectures on Aerodyn. Noise Theory 11 Oct. 1971 p 91-114 refs (See N72-23018 14-02)
Avail: NTIS HC $7.75; DFVRL Porz-Wahn: 27.90 DM

Spectral methods in jet noise theory with emphasis on the solution of numerical relationships are presented. The subjects discussed are (1) a solution of flow equations for frequency components, (2) calculation of the directivity of sound intensity, (3) Fourier analysis of the source term and integral solution, (4) the sound pressure components far from the source region, and (5) sound generation by wave-type jet turbulence. Author

N72-23023# Laboratorium fur Betriebsfestigkeit, Darmstadt (West Germany).
EXTREME VALUE ANALYSIS AND ITS APPLICATION TO CG VERTICAL ACCELERATIONS MEASURED ON TRANSPORT AIRPLANES OF TYPE C-130
Otto Buxbaum Paris AGARD Mar. 1971 25 p refs
(AGARD-579) Avail: NTIS HC $3.25

The interpretation of cumulative frequency distributions of measured flight loads can be increased significantly by an additional extreme value analysis. This method not only leads to a higher reliability in fatigue design but may be used also for a prediction of extreme loading conditions and for a description of the effect of airplane and flight parameters on loads, as is demonstrated for c.g. vertical accelerations and gust velocities measured on airplanes of type C-130. Author

N72-23024*# Scientific Translation Service, Santa Barbara, Calif.
HELICOPTER AERODYNAMICS
D. I. Bazov Washington NASA May 1972 292 p refs Transl. into ENGLISH of the book "Aerodinamika Vertoletov" Moscow, Transport Press, 1969 p 1-190
(Contract NASw-2035)
(NASA-TT-F-676) Avail: NTIS HC $3.00 CSCL 01B

Principles of helicopter flight under various conditions are reviewed, giving special attention to the operation of the main rotor. A brief history of helicopter development is presented, together with a summary of the main components of a helicopter and a classification of the various types of helicopters. The characteristics of the main rotor and its operation during autorotation and during axial and oblique flow are considered. Also considered are vertical and horizontal flight, altitude gain and descent, takeoff and landing, equilibrium, stability, and controllability, taking into account the aerodynamic forces acting on the helicopter during the various maneuvers. Author

N72-23025*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MEASURED NOISE OF MODEL FAN-UNDER-WING AND FAN-ON-FLAP JET FLAP CONFIGURATIONS
John F. Groeneweg and Gene L. Minner Washington May 1972 56 p refs
(NASA-TN-D-6781; E-6739) Avail: NTIS HC $3.00 CSCL 01B

Noise measurements were made on two jet flap systems proposed for STOL aircraft. In one case a 14.0-cm- (5.5-in.-) diameter fan was mounted under the wing such that the exhaust impinged on downwardly deflected flap segments. In the other case, the fan was located on the upper surface of the flap such that fan and flap moved as a unit, with no exhaust impingement. Results for takeoff and approach fan speeds and flap deflections were used to estimate STOL airplane perceived noise levels. Internally generated noise directivity corresponded with fan axis orientation for the fan-on-flap, but no consistent redirection of internal noise was observed with changes in flap angle for the fan-under-wing. With the fan-on-flap arrangement, the wing shielded some fan inlet noise from the ground. Since no impingement of the exhaust on solid surfaces occurred, the external noise was jet noise alone. In contrast, for the fan-under-wing, the jet/flap interaction noise dominated the external noise except at angles near the jet axis even with no flap deflection. If internal noise is reduced by fan design and acoustic treatment, the jet/flap interaction noise will dominate. Author

N72-23026# Boeing Scientific Research Labs., Seattle, Wash. Aerospace Group.
A THEORETICAL MODEL FOR THE HEATING OF AN AIRPLANE WING FROM A LIGHTNING DISCHARGE
F. Edward Ehlers and Donald F. Winter Oct. 1971 27 p refs
(D180-14190-1) Avail: NTIS HC $3.50

It is currently believed that most structural damage from lightning is caused by continuous-prolonged relatively low-current (50 to 2000 amperes) discharges between major strokes. The temperature response of a metal plate to a steady electric current input on its exterior surface is described analytically. The validity of the analysis is limited to intervals of time prior to significant energy loss by vaporization of the metal. Experimental studies indicate that the current density normal to a plate anode from an argon arc is approximated closely by a Gaussian distribution or by a combination of Gaussian distributions. The solution of the heat equation was found for a Gaussian distribution of normal heat flux on one surface of a plate with the other surface insulated. Internal Joule heating is neglected. The analysis was applied to finding the maximum temperature on the insulated side of the plate on the arc axis for various total currents and pulse times. Author

N72-23027*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT-DETERMINED DERIVATIVES AND DYNAMIC CHARACTERISTICS OF THE CV-990 AIRPLANE
Glenn B. Gilyard Washington May 1972 66 p refs
(NASA-TN-D-6777; H-693) Avail: NTIS HC $3.00 CSCL 01C

Flight-determined longitudinal and lateral-directional stability and control derivatives are presented for the CV-990 airplane for various combinations of Mach number, altitude, and flap setting throughout the flight envelope up to a Mach number of 0.87. Also presented are the dynamic characteristics of the aircraft calculated from the flight-obtained derivatives and the measured phugoid characteristics. The derivative characteristics were obtained from flight records of longitudinal and lateral-directional transient oscillation maneuvers by using a modified Newton-Raphson digital derivative determination technique. Generally the derivatives exhibited consistent variation with lift coefficient in the low-speed data and with Mach number and altitude in the high-speed data. Many also varied with flap deflection, notably spoiler effectiveness and directional stability. Author

N72-23028# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE PROBLEM OF PROGRAMMED CONTROL OF FLYING VEHICLE MOTION
S. M. Cherniavskii [1972] 8 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavdenii, Aviats. Tekhn. (Kazan), no. 4, 1971 p 19-27
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The problem of programmed control of flight vehicle motion is discussed. The flight dynamics are investigated in a linear formulation because of the complexity of the relationships. Three specific problems are discussed and mathematical models are presented to support the theoretical concepts. Author

N72-23029# Northrop Corp., Palos Verdes Estates, Calif. Electronics Div.
CONCEPT FORMULATION STUDY FOR AUTOMATIC INSPECTION, DIAGNOSTIC AND PROGNOSTIC SYSTEMS (AIDARS), VOLUME 1 Interim Report
Jul. 1971 77 p refs
(Contract DAAJ01-71-C-0503; DA Proj. 1F1-64204-DC-32)
(AD-736754; NORT-71-229-Vol-1;
USAAVSCOM-TR-72-2-Vol-1; IR-2-Vol-1) Avail: NTIS CSCL 01/3

The report consists of the plan of analysis which describes the models and procedures to be used to perform the trade-offs during Phase C of the Concept Formulation Study for Automatic Inspection, Diagnostic and Prognostic Systems (AIDAPS) for Army aircraft. Section 2.0 describes the AIDAPS/aircraft maintenance analysis and effectiveness model. Section 3.0 presents the AIDAPS system procurement cost model. Section 4.0 discusses the AIDAPS system cost benefit model which compares the life cycle of AIDAPS equipped versus non-AIDAPS equipped aircraft. Section 5.0 references an aircraft maintenance operation model which shall be used in conjunction with the models described in Section 2.0. Section 6.0 presents a summary of the manner in which the optimum system will be selected. Author (GRA)

N72-23030# Northrop Corp., Palos Verdes Estates, Calif. Electronics Div.
CONCEPT FORMULATION STUDY FOR AUTOMATIC INSPECTION, DIAGNOSTIC AND PROGNOSTIC SYSTEMS (AIDAPS), VOLUME 2 Interim Report
Jul. 1971 282 p refs
(Contract DAAJ01-71-C-0503; DA Proj. 1F1-64204-DC-32)
(AD-736755; NORT-71-209-2-Vol-2;
USAAVSCOM-TR-72-2-Vol-2; IR-2-Vol-2) Avail: NTIS CSCL 01/3

The report represents the second interim report prepared as part of the concept formulation study for Automatic Inspection, Diagnostic and Prognostic Systems (AIDAPS) for Army aircraft. The principal objective of this Phase B effort is the identification of AIDAPS technical approaches and concepts that fall within the engineering feasibility limitations established in Phase A. Author (GRA)

N72-23031# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRACTICAL AERODYNAMICS OF THE YAK-40 AIRPLANE
L. E. Bogoslavskii 7 Dec. 1971 250 p refs Transl. into

ENGLISH of the publ. "Prakticheskays Aerodinamika Samoleta Yak-40" USSR, 1970 p 1-176
(Contract F33657-71-D-0057)
(AD-736902; FTD-HC-23-729-71) Avail: NTIS CSCL 01/3

The book presents the geometric and flight characteristics of the Yak-40 passenger airplane, discusses questions of piloting technique, and gives concrete recommendations for performing flight under various conditions. Information is presented on the airplane center-of-gravity, equilibrium, stability and controllability, flight under unusual conditions, piloting the airplane in case of engine failure and in turbulent air. Some basic theory-of-flight information is also covered in order to facilitate the study of practical aerodynamics and flight operations. Author (GRA)

N72-23032# Frost Engineering Development Corp., Englewood, Colo.
DEVELOPMENT OF IMPROVED AIRCRAFT SEAT CUSHIONS AND PARACHUTE SUPPORT SPACERS Final Report, Jul. 1967 - Jan. 1971
Richard H. Frost, Ernest L. Stech, and George K. Russell Aug. 1971 119 p refs
(Contract F33657-67-C-1520)
(AD-736873; Rept-341-9; ASD-TR-71-80) Avail: NTIS CSCL 01/3

The purpose of this program was to improve the efficiency and safety of air crews by development of seat cushions and parachute support spacers which would give superior comfort in long-duration seating yet minimize the incidence of spinal injury in ejections and crash landings. Exhaustive testing of existing cushions and spacers was followed by establishment of criteria for optimum construction. Investigation and development of new materials potentially capable of fulfilling these requirements was made. Author (GRA)

N72-23033# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
CONSTANT ALTITUDE MINIMUM TIME TURNS TO A LINE AND TO A POINT FOR A SUPERSONIC AIRCRAFT WITH A CONSTRAINT ON MAXIMUM VELOCITY Interim Report
Arthur E. Bryson, Jr. and Michael G. Parsons Nov. 1971 69 p refs
(Contract N00014-67-A-0112-0063; NR Proj. 213-085)
(AD-736964; SUDAAR-437) Avail: NTIS CSCL 01/3

Optimal control theory is used to determine the thrust and bank angle programs for minimum time turns of a supersonic aircraft to a specified point or line when constant altitude is maintained. A stall constraint, a maximum velocity placard limit, a maximum normal load constraint, and maximum and minimum thrust limits are imposed. Numerical results are presented for a typical supersonics aircraft at 25,000 feet altitude when the turns are such that an intermediate thrust arc at the maximum velocity placard limit is reached during the flight. These turns are characterized by a period of straight flight at maximum velocity. Author (GRA)

N72-23034# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AIRCRAFT ROCKET SUBSYSTEMS Final Report
15 Jan. 1972 26 p refs
(AD-737177; MTP-7-2-009) Avail: NTIS CSCL 01/3

The report describes a method for the evaluation of air to ground rocket subsystem performance characteristics. It provides procedures for test preparation, physical characteristics, safety evaluation, high temperature (-145 F), low temperature (-50 F), sand, dust, humidity, salt spray, fungus, rain, freezing rain, vibration, static loading, firing tests, durability, accuracy, and dispersion. GRA

N72-23035# Naval Air Test Center, Patuxent River, Md.
FLIGHT INVESTIGATION OF THE OPTIMUM ENERGY FLIGHT PATH OF AN F-8D AIRPLANE Final Report
F. T. Bryan 4 Feb. 1972 22 p refs
(AD-737377; NATC-FT-9R-72) Avail: NTIS CSCL 01/2

A thirteen flight program was conducted to determine a minimum time optimum energy flight path schedule for a test F-8D airplane and to provide data for a comparison of the time required to achieve equivalent supersonic energy levels when utilizing this schedule and two other predetermined flight path schedules. Author (GRA)

N72-23036# Naval Air Systems Command, Washington, D.C. Professional Development Center.
A NEW APPROACH TO THE CALCULATION OF THE EFFECT OF THE GROUND ON THE PERFORMANCE OF ROTARY WING AIRCRAFT
Eugene M. Newman 1 Nov. 1971 29 p refs
(AD-736925; SP-71-02) Avail: NTIS CSCL 01/3

An investigation of the helicopter ground effect prediction methodology was made and evaluated. Prediction of IGE performance for single rotor helicopters of a conventional type at z/D's greater than .4 can be attained with a resonable degree of accuracy through the use of empirical curves which consider rotor geometry only. Improved accuracy can be attained by use of the new method developed for this investigation which gives results that reflect changes in fuselage shape as well as rotor geometry. While insufficient data was available, the new method appears to provide a means of predicting ground effect for compound type vehicle that entail significant configuration changes. Author (GRA)

N72-23037# Air Force Academy, Colo.
STRUCTURAL FLIGHT TEST OF AN AC-130A GUNSHIP EMPENNAGE
John J. Russell Oct. 1971 55 p refs
(AD-737350; USAFA-RR-71-9) Avail: NTIS CSCL 01/3

An AC-130A aircraft empennage was instrumented with electrical-resistance strain gages and flight test data was obtained for antiaircraft evasive maneuvers, 20mm General Electric Vulcan cannon firings, and 40mm Bofors gun firings. Complete descriptions of the test instrumentation, test conditions, strain gage locations, and results are contained in the report. Strain gages were located in the aircraft empennage area based on minimum margins of safety as found in the original Lockheed stress analysis. Results show that those stresses caused by gun firing, either 20mm or 40mm, are quite small and that the sum of the stresses due to the left hand orbit maneuver and the gun firing is well below design limits. Stresses produced by antiaircraft evasive maneuvers were also found to be well below design limits. Author (GRA)

N72-23038# Advisory Group for Aerospace Research and Development, Paris (France).
THE ACCUMULATION FATIGUE DAMAGE IN AIRCRAFT MATERIALS AND STRUCTURES
J. Schijve (Natl. Aerospace Lab., Amsterdam) Jan. 1972 125 p refs
(AD-737398; AGARD-AG-157; AGARDograph-157) Avail: NTIS CSCL 01/3

The available literature is surveyed and analysed. Physical aspects of fatigue damage accumulation are discussed, including interaction and sequence effects. Empirical trends observed in variable-amplitude tests are summarized including the effects of a high preload, periodical high loads, ground-to-air cycles and the variables pertaining to program loading, random loading and flight-simulation loading. This also includes results from full-scale fatigue test series. Various theories on fatigue damage accumulation are recapitulated. The significance of these theories for explaining empirical trends as well as for estimating fatigue properties as a design problem is evaluated. Author

N72-23039# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
FLIGHT EVALUATION OF ENGINE RESPONSE, FLIGHT

PATH STABILITY, TAIL LIFT, AND DIRECT LIFT CONTROL Final Report, Jul. 1969 - Oct. 1971
George E. Miller and Robert L. Traskos Aug. 1971 113 p refs
(Contract N00019-70-C-0156)
(AD-736968; Rept-888) Avail: NTIS CSCL 01/3

The results of an aircraft flying qualities research program sponsored by the Naval Air Systems Command are presented. For a simulated carrier approach task, numerical pilot ratings and specific comments were obtained from Navy test pilots. The parameters evaluated were the engine response, flight path stability, tail lift, and direct lift control. Data are presented in the form of pilot opinion maps of the parameters, tabulated configuration ratings, and pilot comments. Author (GRA)

N72-23040# National Transportation Safety Board, Washington, D.C. Bureau of Aviation Safety.
BRIEFS OF AIRCRAFT ACCIDENTS INVOLVING AMATEUR/HOME BUILT AIRCRAFT, US GENERAL AVIATION, 1969
1971 45 p
(PB-206040; NTSB-AMM-71-13) Avail: NTIS HC $3.00 CSCL 01B

The publication contains statistical, cause/factor and injury tables, accident rates and the briefs of accidents involving amateur/home built aircraft 1969. Author (GRA)

N72-23041# Honeywell, Inc., St. Paul, Minn. Systems and Research Center.
IFR MANUAL FORMATION FLIGHT: DISPLAY EVALUATION AND INVESTIGATION OF SKILL ACQUISITION AND SYSTEM FAILURES Final Technical Report, Jul. 1970 - Jun. 1971
P. A. Anderson and S. R. Hollingsworth Jan. 1972 148 p refs
(Contract N00014-66-C-0362; NR Proj. 213-054)
(AD-737313; JANAIR-710602; Honeywell-12543-FR7) Avail: NTIS CSCL 01/4

Man-in-the loop simulations were conducted to evaluate pilot/system performance for the UH-1 helicopter under various experimental conditions. The empirical results indicated that there were no major performance differences between the IHAS and IEVD display formats although the IEVD tended to yield lower position errors and control stick rates; experienced and inexperienced pilots learned the formation-flight task in a relatively short period of time when display augmentation (quickening) was provided; approximately the same level of control precision was acquired by both groups of pilots; position control performance degraded drastically when augmentation was downgraded or removed from the display; the pilots could successfully leave formation with or without command information, but the maneuver was more precise with the commands; and acceptable formation-flight performance was obtained with an electromechanical flight director display system although the simulated collision warning system was not capable of avoiding all collisions. Author (GRA)

N72-23042# Douglas Aircraft Co., Inc., Long Beach, Calif.
THEORETICAL STUDIES ON THE AERODYNAMICS OF SLAT AIRFOIL COMBINATIONS Final Report
Robert H. Liebeck 28 May 1971 67 p refs
(Contract F44620-70-C-0108; AF Proj. 9781)
(AD-737126; MDC-J5195; AFOSR-72-0369TR) Avail: NTIS CSCL 01/3

The report describes the results of a theoretical study on the analysis and design of leading edge slat plus main airfoil combinations. Two basic methods were used: representation of the slat by a point vortex, and representation of the slat by a set of thin airfoil theory singularity distributions. Computer programs were prepared. For method 1 the main airfoil was chosen from an infinite set of airfoils whose mapping functions to the unit circle are analytically defined. A leading edge slat providing a specified velocity modulation on the nose region of a main airfoil was studied by method 2. GRA

N72-23043# Instrument Pilot Instructor School, Randolph AFB, Tex.
EVALUATION OF MODIFICATION PROPOSAL TO INCREASE ADI AND HSI LIGHTING ON T-38 AIRCRAFT
Max L. Odle Dec. 1971 47 p refs
(AD-737121; IPIS-71-4) Avail: NTIS CSCL 13/1

The Test and Evaluation Branch of the United States Air Force Instrument Pilot Instructor School (IPIS) conducted an evaluation of a modified T-38 Attitude Director Indicator/Horizontal Situation Indicator (ADI/HSI) lighting system proposed by the Deputy for Materiel, Moody AFB, Georgia. The modification specified removal of a 0.25 ohm resistor from the ADI/HSI lighting system. For evaluation purposes, five T-38 front and back sea ADI/HSI lighting systems were modified. The modified aircraft were then scheduled with unmodified T-38s for night flying. Subject pilots were not made aware that modifications had been completed on any aircraft to avoid biased questionnaires. Eighty-five subjective questionnaires were completed by a diversified group of student instructor pilots and instructor pilots. Ten pilots of this group flew the modified aircraft. Author (GRA)

N72-23044# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT, ROCKY MOUNTAIN AIRWAYS, INCORPORATED AERO COMMANDER 680V, N6359U, ASPEN, COLORADO, 22 JANUARY 1970
29 Dec. 1971 33 p refs
(PB-206562; NTSB-AAR-72-01) Avail: NTIS HC $3.00 CSCL 01B

Aero Commander 680V, N6395U, crashed at approximately 0806 mountain standard time, January 22, 1970, near Aspen, Colorado. The aircraft struck obstructing terrain after the pilot discontinued an approach to land because of an ice accumulation on the windshield of the aircraft. The National Transportation Safety Board determines that the probable cause of this accident was the pilot's use of other than the recommended procedures for a go-around following the discontinuance of a landing approach. The landing approach was discontinued, and a go-around attempted because the aircraft was too high to attempt a straight-in approach. The ice accumulation on the windshield obscured the obstructing terrain. Author (GRA)

N72-23045# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD ANNUAL MEETING
1971 79 p Conf. held at Nord-Torpa, Norway, 8 Sep. 1971
(AD-737396) Avail: NTIS CSCL 01/2

Each autumn, AGARD holds its annual meeting in one of the NATO member nations to develop general guide lines for future activities. This gives the host nation the opportunity to present its research and development program from the standpoint of the government, industry and the universities. The 1971 AGARD annual meeting was hosted by the Norwegian Government at the Spatind Hotel, Nord-Torpa, Norway, 8 September 1971. Author (GRA)

N72-23046# Explosive Technology, Inc., Fairfield, Calif.
AN EMERGENCY LIFE-SAVING INSTANT EXIT SYSTEM FOR CARGO, CARGO-TRANSPORT AND PASSENGER AIRCRAFT, VOLUME 1 Technical Report, May 1970 - Jul. 1971
Dallas E. Nicholson and Frank B. Burkdoll Wright-Patterson AFB, Ohio AFSC Aeron. Systems Div. Jun. 1971 92 p refs
(Contract F33657-70-C-1138)
(AD-736056; ASD-TR-71-41-Vol-1) Avail: NTIS CSCL 06/7

The results of a design study and ground testing of an Emergency Life-Saving Instant Exit (ELSIE) System for military and commercial cargo, cargo-transport and passenger aircraft are described. The ELSIE System opens emergency exits in aircraft almost instantaneously and can be designed to open all exits at one time or on a selective basis. The design evolved from Explosive Technology's STEN (Stored Energy) Passenger Egress

System originally developed in 1967 and continuously demonstrated since then. The contracted work represented the design and testing of an ELSIE System specifically for demonstration on a C-131B test-bed aircraft. This document is Volume I of a two-volume report. Author (GRA)

N72-23047# Naval Postgraduate School, Monterey, Calif.
INTERFACE OF MATERIALS AND STRUCTURES ON AIRFRAMES. PART 3: DESIGN PROBLEMS IN AIRCRAFT STRUCTURES INCLUDING PROCEEDINGS OF MONTEREY SYMPOSIUM Final Report
Ulrich Haupt Oct. 1971 232 p refs Conf. held at Monterey, Calif., 15-16 Jul. 1971
(AD-736207; NPS-57HP71111A-Pt-3) Avail: NTIS CSCL 01/3

The proceedings of the Monterey Symposium on Design Problems in Aircraft Structures provide a basic survey of design problems from the engineers's viewpoint. Further analysis of the present situation draws attention to some essential aspects which are not yet generally recognized. This leads to the conclusion that recent design problems cannot be solved on a technological level alone. An organizational effort is needed to disseminate available information. Beyond this, the complexity of interactions must be understood more thoroughly and this requires an educational effort on a broad basis. A practical and systematic approach toward the solution of these problems is developed Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators, and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N72-23048* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMAL TO ELECTRICAL POWER CONVERSION SYSTEM WITH SOLID-STATE SWITCHES WITH SEEBECK EFFECT COMPENSATION Patent
Katsunori Shimada, inventor (to NASA) Issued 7 Mar. 1972 7 p
(NASA-Case-NPO-11388; US-Patent-3,648,152; US-Patent-Appl-SN-119282; US-Patent-Class-322-2; US-Patent-Class-310-2; US-Patent-Class-321-2) Avail: US Patent Office CSCL 10A

A thermal to electrical power conversion system is described in which switching of electrical currents to a load is performed by solid-state switches in which their Seebeck effect reduces the losses due to the ohmic voltage drops. In a system with a thermoelectric generator as the power source, the switches are designed with their source electrodes formed by the generator's cold shoe at a temperature higher than a remotely located heat sink which forms the switches drain electrodes. The gate electrodes of the switches are connected to an electronic switch controller, which controls their conduction and cutoff states. Official Gazette of the U.S. Patent Office

N72-23049*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation and Engineering Lab. Dept.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: ACCEPTANCE TEST OF EAGLE-PICHER 100 AMPERE-HOUR NICKEL-CADMIUM CELLS WITH AUXILIARY ELECTRODES
D. E. Christy 10 Mar. 1972 24 p
(NASA Order S-23404-G)
(NASA-CR-126384; QEEL/C-72-126) Avail: NTIS HC $3.25 CSCL 10A

Tests were conducted on a group of 29 cells for the purpose of removing from the life cycle program all cells found to have electrolyte leakage, internal shorts, low capacity, or inability to recover open circuit voltage above 1.150 volts after the cell short test. The test findings include the following: (1) All the cells exceeded the rated capacity of 103.5 to 119.0 ampere-hours on all three capacity checks. (2) All cells recovered above the 1.150 volt requirement after the cell short test. (3) The cells cannot be overcharged at the c/10 rate without exceeding 1.500 volts after approximately 12 to 13 hours of charge. (4) The resistance value necessary to provide maximum signal power across the auxiliary electrode was found to be 10 ohms. (5) One cell revealed a definite leak at the negative terminal. D.L.G.

N72-23050*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation and Engineering Lab. Dept.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: ACCEPTANCE TESTS OF EAGLE-PICHER 20.0 AMPERE-HOUR NICKEL-CADMIUM CELLS WITH AUXILIARY ELECTRODES
D. E. Christy 21 Mar. 1972 30 p
(NASA Order S-23404-G)
(NASA-CR-126385; QEEL/C-72-127) Avail: NTIS HC $3.50 CSCL 10A

A group of 29 cells with capacities ranging from 21.7 to 28.8 ampere-hours were tested. A summary of the results indicates: (1) All cells exceeded the rated capacity on all three capacity checks. (2) Five cells failed to recover to 1.150 volts. (3) During the overcharge tests, 15 of the 29 cells had to be removed from charge before completion of the respective tests due to high pressure. D.L.G.

N72-23051*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADVANCED SPACECRAFT FUEL CELL SYSTEMS
L. H. Thaller 25 May 1972 13 p refs Presented at 25th Power Sources Symp., Atlantic City, 23-25 May 1972; Sponsored by Army Materiel Command
(NASA-TM-X-68033; E-6853) Avail: NTIS HC $3.00 CSCL 10A

The development and characteristics of advanced spacecraft fuel cell systems are discussed. The system is designed to operate on low pressure, propulsion grade hydrogen and oxygen. The specific goals are 10,000 hours of operation with refurbishment, 20 pounds per kilowatt at a sustained power of 7 KW, and 21 KW peaking capability for durations of two hours. The system rejects waste heat to the spacecraft cooling system at power levels up to 7 KW. At higher powers, the system automatically transfers to open cycle operation with overboard steam venting. Author

N72-23052*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A RELIABLE ALL-SILVER FRONT CONTACT FOR SILICON SOLAR CELLS
John H. Lamneck, Jr. and Lawrence Schwartz Washington May 1972 24 p refs
(NASA-TM-X-2544; E-6643) Avail: NTIS HC $3.00 CSCL 10A

The feasibility of making an adherent and moisture degradation resistant silver-only front contact to silicon solar cells was demonstrated. Optimum fabrication processes and process sequences were determined for making such contacts. These contacts were found to also have good electrical characteristics. A back contact of aluminum-silver was also developed. This proved very satisfactory for low-temperature applications. Author

N72-23053*# General Electric Co., Lynn, Mass. Aircraft Energy Conversion Div.
FUEL CELL TECHNOLOGY PROGRAM Summary report
25 Aug. 1972 22 p
(Contract NAS9-11033)

(NASA-CR-115572; SPR-046) Avail: NTIS HC $3.25 CSCL 10A

A program to advance the technology for a cost-effective hydrogen/oxygen fuel cell system for future manned spacecraft is discussed. The evaluation of base line design concepts and the development of product improvements in the areas of life, power, specific weight and volume, versatility of operation, field maintenance and thermal control were conducted from the material and component level through the fabrication and test of an engineering model of the fuel cell system. The program was to be accomplished in a 13 month period. Author

N72-23054*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PRELIMINARY DESIGN OF A SOLAR HEAT RECEIVER FOR A BRAYTON CYCLE SPACE POWER SYSTEM

Harry M. Cameron, Lawrence A. Mueller, and David Namkoong Washington May 1972 41 p refs

(NASA-TM-X-2552; E-6740) Avail: NTIS HC $3.00 CSCL 10A

The preliminary design of a solar heat receiver for use as a heat source for an earth-orbiting 11-kWe Brayton-cycle engine is described. The result was a cavity heat receiver having the shape of a frustum of a cone. The wall of the cone is formed by 48 heat-transfer tubes, each tube containing pockets of lithium fluoride for storing heat for as much as 38 minutes of fullpower operation in the shade. Doors are provided in order to dump excess heat especially during operation in orbits with full sun exposure. The receiver material is predominantly columbium - 1-percent-zironium (Cb-1Zr) alloy. Full-scale testing of three heat-transfer tubes for more than 2000 hours and 1250 sun-shade cycles verified the design concept. Author

N72-23055*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SILICON SOLAR CELL EFFICIENCY: PRACTICE AND PROMISE

Henry W. Brandhorst, Jr. 1972 8 p refs Presented at the 9th Photovoltaic Specialists Conf., Silver Spring, Md., 2-5 May 1972

(NASA-TM-X-68057; E-6915) Avail: NTIS HC $3.00 CSCL 10A

The maximum efficiency of silicon solar cells was calculated and yielded a value near 18%. Additionally, the performance of these high efficiency cells in a synchronous orbit radiation field was calculated and it is suggested that these cells would be superior to present silicon cells. The performance of conventional cells was analyzed and several areas in which performance gains may be achieved are discussed. These areas include improvements in diffused region profile, in reduction of excess forward currents in cells made from low resistivity material, and in the theory for describing complex solar cell structures. Author

N72-23056*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PREDICTABILITY OF BRAYTON ELECTRIC POWER SYSTEM PERFORMANCE

John L. Klann and Henry J. Hettel Washington May 1972 23 p refs

(NASA-TN-D-6808; E-6811) Avail: NTIS HC $3.00 CSCL 10A

Data from the first tests of the 2- to 15-kilowatt space power system in a vacuum chamber were compared with predictions of both a pretest analysis and a modified version of that analysis. The pretest analysis predicted test results with differences of no more than 9 percent of the largest measured value for each quantity. The modified analysis correlated measurements. Differences in conversion efficiency and power output were no greater than plus or minus 2.5 percent. This modified analysis was used to project space performance maps for the current test system. Author

N72-23057*# Rocketdyne, Canoga Park, Calif.

SPACE SHUTTLE AUXILIARY POWER UNIT STUDY, PHASE 2

R. L. Binsley, A. A. Krause, R. D. Maddox, R. D. Marcy, and R.S. Siegler Washington NASA Apr. 1972 302 p

(Contract NAS3-14407)

(NASA-CR-2001; R-8754) Avail: NTIS HC $6.00 CSCL 10A

A study was performed to establish the preliminary design of the space shuttle auxiliary power unit. Details of the analysis, optimizations, and design of the components, subsystems and systems are presented. Author

N72-23058# Oak Ridge National Lab., Tenn.

ISOTOPE KILOWATT PROGRAM Quarterly Progress Report, period ending 30 Sep. 1971

A. P. Fraas and G. Samuels Nov. 1971 39 p refs

(Contract W-7405-eng-26)

(ORNL-TM-3592) Avail: NTIS

The organic capsule test continued during the quarter and completed 6576 h or operation. Construction of the 1/4-scale organic fluid decomposition test loop is proceeding. Most of the components have been fabricated and the measurements of the dose rates in the boiler region of the heat block shield were completed. Efforts to correct conditions that might cause a loss in the capillary pumping capacity of the heat pipe have continued to meet with little success; a pronounced loss in performance still occurs when the boiler is tilted a bit above the level of the condenser. Further investigation was discontinued due to lack of funds. Performance tests on the thermoelectric module were completed and the unit was delivered to ORNL for further testing. Author (NSA)

N72-23059# California Univ., Livermore. Lawrence Livermore Lab.

EQUIVALENT CIRCUIT MODELS AND THE CHARACTERISTICS OF REFERENCE AND COUNTER ELECTRODES IN CONTROLLED-POTENTIAL ELECTROLYSIS CELLS

J. E. Harrar 29 Nov. 1971 18 p refs

(Contract W-7405-eng-48)

(UCRL-51154) Avail: NTIS HC $3.00

The various circuit models that have been proposed for controlled-potential electrolysis cells are reviewed. Vector-impedance measurements were made of some typical reference electrode assemblies and an equivalent circuit is proposed for this portion of the cell. Some aspects of the distributed capacity of the reference electrode assembly are discussed. The nonlinearity of a platinum electrode evolving hydrogen and oxygen at various dc current levels was measured in terms of its distortion of a sine wave signal. These data, which show that it is quite nonlinear, give an indication of how a counter electrode functions in a three-electrode cell. Author

N72-23060# British Aircraft Corp., Stevenage (England).

SATELLITE FLYWHEEL Design Report

L. D. G. Barwell, C. D. Goward, A. H. King, and D. F. Morton Paris ESRO Mar. 1970 100 p refs Prepared for ESRO

(Contract ESTEC-568-68)

(ESRO-CR-28) Avail: NTIS HC $7.00

The design and predicted performance of a satellite flywheel using gas bearings are presented. Details of the rotor assembly, gas bearings, case assembly, tachometer, and motor power supplies, are given. The flywheel will use a hysteresis motor for in-flight operation and an induction motor for ground start. Both of these motors are described in detail. Author (ESRO)

N72-23061# Battelle Memorial Inst., Columbus, Ohio.

SIMULATED ORBITAL LIFE TESTS FOR SPACECRAFT CELLS. PART 1: PROCEDURES AND MANUALLY ACQUIRED DATA

Earl A. Roeger, Jr. and John McCallum Wright-Patterson AFB, Ohio AFAPL Jan. 1972 113 p refs

(Contracts F33615-69-C-1537; AF Proj. 3145)

(AD-736471; AFAPL-TR-71-74-Pt-1) Avail: NTIS CSCL 01/3

Information concerned with the life testing of sealed nickel-cadmium cells is presented under conditions which simulate

both sychronous (24 hours) and polar (5.31 hours) spacecraft orbital applications. The report describes the life tests, records how cells were selected and conditioned for test groups, and summarizes all the manually acquired data. Author (GRA)

N72-23062# Energy Research Corp., Bethel, Conn.
INEXPENSIVE CATHODE CATALYSTS Interim Technical Report, Apr. - Dec. 1971
Bernard S. Baker and Ralph N. Camp 3 Dec. 1971 53 p refs
(Contract DAAK02-71-C-0302)
(AD-737284; ERC-6712S) Avail: NTIS CSCL 10/2

An inexpensive air cathode is being developed for use in acid electrolyte fuel cells. The electrode consists of a layer of polytetrafluoroethylene bonded platinum black catalyst loaded at 1 to 3 gm/sq ft supported on a low cost porous graphite sheet, eliminating the need for a metal grid. Test procedures for characterizing electrode structure, and performance including conductivity, pore size distribution, surface area, oxygen-air gain and individual electrode polarization measurements are discussed in the report. Cathodes containing 2 gm/sq ft of platinum with small amounts of graphite as a bulking agent yield similar results. Cost estimates are presented. Author (GRA)

N72-23063# Bureau of Reclamation, Denver, Colo. Engineering and Research Center.
DRAFT TUBE SURGES. A REVIEW OF PRESENT KNOWLEDGE AND AN ANNOTATED BIBLIOGRAPHY
H. T. Falvey Dec. 1971 31 p refs
(PB-206600; REC-ERC-71-42) Avail: NTIS HC $3.00 CSCL 10A

A literature survey and a review of material related to draft tube surges is presented. The literature survey consists of an annotated bibliography of 68 articles published between 1910 and 1970. The review is restricted to three major areas: experiments with elementary models, experiments with model and prototype turbines, and field expedients to reduce surging. Velocity distributions and surge frequencies are given special attention in the first two areas. Present knowledge is sufficient for predicting the order of magnitude of draft tube surge frequencies and relative surge amplitudes. Author (GRA)

N72-23064# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
DESCRIPTION OF A HIGH PRESSURE ELECTROFLUID DYNAMIC (EFD) FACILITY Final Scientific Report
Theodore L. Willke and Ernest F. Fretter Nov. 1971 59 p refs
(AF Proj. 7116)
(AD-737380; ARL-71-0260) Avail: NTIS CSCL 10/2

A facility is described which simulates EFD generator operation using high pressure air as the working fluid. The humidity, temperature, mass flow, and pressure of the air can be controlled and monitored in two nearly identical air systems. The working fluid is supplied to one of three high pressure list stands enclosing experimental EFD conversion channels. Excitation voltage of up to 150 KV and generate voltages up to 2000 KV are supplied. Types and specifications of various types of instruments are described as well as the types of experiments performed. Author (GRA)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N72-23065*# Research Triangle Inst., Durham, N.C.
APPLICATIONS OF AEROSPACE TECHNOLOGY IN BIOLOGY AND MEDICINE Semiannual Report, 1 April - 31 Dec. 1971
Dec. 1971 106 p refs
(Contracts NASw-1950; NASw-2273)
(NASA-CR-126404) Avail: NTIS HC $7.50 CSCL 06C

The medically related activities of the NASA Application Team Program at the Research Triangle Institute between April 1, 1971, and December 31, 1971 are reported. Relevant aerospace technology utilization is illustrated in various bioinstrumentation systems for detection and monitoring of clinical and rehabilitation problems. For individual titles, see N72-23066 through N72-23069.

N72-23066*# Research Triangle Inst., Durham, N.C.
[MEDICALLY RELATED ACTIVITIES OF APPLICATION TEAM PROGRAM]
In its Appl. of Aerospace Tech. in Biol. and Med. Dec. 1971 53 p (See N72-23065 14-04)
Avail: NTIS HC $7.50 CSCL 06E

Application team methodology identifies and specifies problems in technology transfer programs to biomedical areas through direct contact with users of aerospace technology. The availability of reengineering sources increases impact of the program on the medical community and results in broad scale application of some bioinstrumentation systems. Examples are given that include devices adapted to the rehabilitation of neuromuscular disorders, power sources for artificial organs, and automated monitoring and detection equipment in clinical medicine. G.G.

N72-23067*# Research Triangle Inst., Durham, N.C.
FUTURE NEEDS FOR BIOMEDICAL TRANSDUCERS c05
F. Thomas Wooten *In its* Appl. of Aerospace Tech. in Biol. and Med. Dec. 1971 9 p refs Presented at Inst. of Elec. and Electron. Engr. Transducer Conf., Washington, D. C., 6 Oct. 1971 (See N72-23065 14-04)
Avail: NTIS HC $7.50 CSCL 06B

In summary there are three major classes of transducer improvements required: improvements in existing transducers, needs for unexploited physical science phenomena in transducer design, and needs for unutilized physiological phenomena in transducer design. During the next decade, increasing emphasis will be placed on noninvasive measurement in all of these areas. Patient safety, patient comfort, and the need for efficient utilization of the time of both patient and physician requires that noninvasive methods of monitoring be developed. Author

N72-23068*# Research Triangle Inst., Durham, N.C.
INTERDISCIPLINARY BARRIERS: AN IMPEDIMENT TO THE EFFECTIVE APPLICATION OF SYSTEMS ENGINEERING c34
Ernest Harrison, Jr. *In its* Appl. of Aerospace Tech. in Biol. and Med. Dec. 1971 29 p refs Presented at 1971 Ann. Conf. of the Am. Occupational Therapy Assoc., Cleveland, 1 Nov. 1971 (See N72-23065 14-04)
Avail: NTIS HC $7.50 CSCL 05B

Interdisciplinary transfer of information and technology does not occur very readily, even for system planners, because of the existence of some very real barriers. These barriers to flow of information and technology between disciplines represent one of the important difficulties associated with the application of systems analysis to many problems. The nature and characteristics of some of these barriers are enumerated and discussed in detail. A number of methodologies and techniques which have been specifically developed to aid in the transfer of technology and information across these interdisciplinary barriers is examined. Author

N72-23069*# Research Triangle Inst., Durham, N.C.
ADVANCEMENTS IN MEDICINE FROM AEROSPACE RESEARCH
F. Thomas Wooten *In its* Appl. of Aerospace Tech. in Biol. and Med. Dec. 1971 10 p Presented at Conf. on Space for Mankind's Benefit, Huntsville, Ala., 16-19 Nov. 1971 (See

N72-23065 14-04)
Avail: NTIS HC $7.50 CSCL 06E

NASA has taken the lead in implementing the concept of technology utilization, and the Technology Utilization Program is the first vital step in the goal of a technological society to insure maximum benefit from the costs of technology. Experience has shown that the active approach to technology transfer is unique and is well received in the medical profession when appropriate problems are tackled. The problem solving approach is a useful one at the precise time when medicine is recognizing the need for new technology. Author

N72-23070*# West Virginia Univ., Morgantown.
THE EFFECT OF CHANGING GRAVITY AND WEIGHTLESSNESS OF VASOPRESSIN CONTROL SYSTEMS Progress Report, 16 Feb. 1971 - 15 Feb. 1972
Walter H. Moran 15 Feb. 1972 12 p ref
(Grant NGR-49-001-019)
(NASA-CR-126395) Avail: NTIS HC $3.00 CSCL 06P

An immunoassay to determine the effects of changing gravity and weightlessness on vasopressin control system is discussed. Seven extracts from persons known to have inappropriate ADH syndrome secondary to pulmonary oat cell cancer were examined. The extracts had previously been subject to bioassay in rats. The intent of the examination was to determine if the vasopressin content could be confirmed immunologically. The results compared favorably with the values obtained by biological assay. Author

N72-23071*# Scripta Technica, Inc., Washington, D.C.
THE BRAIN OF HIBERNATING ANIMALS
M. B. Shtark NASA May 1972 230 p refs Transl. into ENGLISH of the book "Mozg Zimnespyashchikh" Novosibirsk, Nauka Press, 1970 p 1-240
(Contract NASw-2036)
(NASA-TT-F-619; F-619) Avail: NTIS HC $3.00 CSCL 06C

Based on an analysis of the bioelectrical, histochemical and electron microscopic changes in the hibernating brain, a neurophysiological concept of hibernation is formulated. Attempts were made to establish the basic laws of functional organization of the cooled hibernant brain. A detailed description is given of the electrical changes in the brain of hibernating animals during all stages of natural adaptation: from active wakefulness to incipient hibernation, torpor, and first tentative and then definitive arousal. The data obtained show that the conservation of cerebral activity at extremely low temperatures is not only a consequence of the genetically determined resistance of the tissues of the hibernant brain, but also of the characteristic organization of the interneuronal and systemic interaction between the cortical and subcortical structures. Author

N72-23072# Lockheed Missiles and Space Co., Palo Alto, Calif.
RESULTS OF BIOLOGICAL INVESTIGATIONS PERFORMED ON THE ZOND-5, ZOND-6 AND ZOND-7
O. G. Gakenko, V. V. Antipov, and G. P. Parfenov [1972] 11 p refs Transl. into ENGLISH from Kosmich. issled. (Moscow), v. 9, no. 4, 1971 p 601-609 Presented at the 21st Intern. Astronaut. Congr., West Ger., 4-10 Oct. 1970
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The fundamental results of several biological experiments performed onboard Zond 5, Zond 6, and Zond 7 are analyzed. The experiments were made to determine changes in structure and functions of biological objects subjected to weightlessness, ionizing radiation, and other flight factors on the earth-moon-earth track. Turtles, drosophylla, spinderwart, turnip-like onion bulbs, dry wheat seeds, different strains of chlorella, and Escherichia coli were used as subjects. The analysis revealed that physiological shifts in turtles were caused by factors not associated with flight conditions. Other results show chromosome rearrangements for the seeds; mutations, increased death rate, and developmental delays for bacteria. Detailed results are given in tables. E.H.W.

N72-23073*# North Carolina State Univ., Raleigh.
THE RELATION BETWEEN TIME OF PRESENTATION AND THE SLEEP DISTURBING EFFECTS OF NOCTURNALLY OCCURRING JET AIRCRAFT FLYOVERS
T. E. LeVere, Raymond T. Bartus, and F. D. Hart Washington NASA May 1972 24 p refs
(Grant NGL-34-002-095)
(NASA-CR-2036) Avail: NTIS HC $3.00 CSCL 06P

The research describes the sleep disturbing effects of jet aircraft flyover noise as it occurs at different times during the night. The results indicate that individuals respond statistically more, in terms of greater cortical desynchronization, during the first and last thirds of the night. During the middle third, while there is still a significant amount of cortical desynchronization in response to the jet aircraft noise, this is always less than that which occurs earlier or later in the night. The implications of this data are that it might be possible to reduce the disruptive effects of at least certain extrinsic sonic stimulation by appropriate scheduling. Author

N72-23074# California Univ., Berkeley. Lawrence Radiation Lab.
RADIATION AND RISK: THE SOURCE DATA
H. Wade Patterson and Ralph H. Thomas Jul. 1971 52 p refs Presented at 6th Symp. on Mathematical Statistics and Probability, Berkeley, Calif., 19 Jul. 1971
(Contract W-7405-eng-48)
(LBL-331; Conf-710716-2) Avail: NTIS

It is perhaps true that more is known of man's response to ionizing radiations than to any other self-inflicted pollutant of his environment. From early X-ray radiation injury experiences and from studies on certain other groups of individuals subjected to high radiation exposures as a result of radiotherapy, nuclear weapons attack, or radiation accidents, a limited amount of information has been pieced together. Such information is almost entirely about the effects of large exposures and high dose-rates. If we are to make any progress in the difficult task of understanding the possible deleterious effects on the health of the population due to small exposures to ionizing radiation at low dose rates it is clear that much greater efforts at interdisciplinary studies are needed. Man's natural radiation environment results in whole-body exposures that vary from about 100 mrem/y to an upper limit of a few rem/y. Man-made radiation levels are, with one exception, small compared even with the fluctuations in these natural levels due to geography and personal habits. The one exception is due to exposure during medical radiology. Author (NSA)

N72-23075# Los Alamos Scientific Lab., N.Mex.
BIOLOGICAL IMPLICATIONS OF THE TRANSURANIUM ELEMENTS FOR MAN
Wright H. Langham 1971 32 p refs Presented at 11th Symp. on Biol. Implications of the Transuranium Elements, Richland, Wash., 27 Sep. 1971 Sponsored by AEC
(LA-DC-13083; Conf-710919-4) Avail: NTIS

Data on the annual production rate of Pu(238) and Pu(239) for use in medical and space programs are projected to the year 2000. The biological implications of Pu accumulation in man and his environment are considered. The Pu protection programs initiated by the USAEC, Canada, and the UK in 1949 are reviewed. Recommendations of the ICRP (1951) of 0.04 micro-Ci as the maximum permissible amount of Pu(239) fixed in the human body, with maximum air and water concentrations derived accordingly, are reported. Data accumulated since 1950 from studies on the long-term chronic toxicity of inhaled, injected, and ingested Pu in animals are discussed. Recommendations for research studies on Pu inhalation and Pu transport through soil-plant-man food chains to ensure continued protection of man against the hazards from environmental Pu are included. Author (NSA)

N72-23076# Billings and Gussman, Inc., Waltham, Mass.
HANDBOOK OF AERSOL BEHAVIOR IN SATURATION DIVING ENVIRONMENTS Final Report

Robert A. Gussman, Anthony M. Sacco, John Beeckmans, Charles E. Billings, and Robert Abilock 1 Oct. 1971 226 p refs
(Contract N00014-71-M-0006; NR Proj. 108-948; PR041-06-01)
(AD-735960; OC-108) Avail: NTIS CSCL 06/11

The project which forms the basis for this handbook was an investigation of aerosol behavior in high pressure environments. Deep submergence saturation diving habitats utilize synthetic respirable atmospheres at hydrostatic pressures equivalent to the depth, and allow free diver excursions to the surrounding sea for tasks such as marine research, salvage and mining. During extended submerged operations, recycled respiration gas atmospheres may become contaminated by emissions from construction materials, protective coatings, instruments, control system components, and from occupants and their operations and activities associated with prolonged habitation in a closed environment. The specific environment considered was the helium-oxygen atmosphere used in saturation diving environments for depths to 1,000 feet. In order to proceed in as logical a fashion as possible and yet deal with the several interrelated aspects of the problem simultaneously, a clear statement of goals was necessary. (1) Investigate and extrapolate the possibly altered behavior of aerosols in the helium-oxygen environment. (2) Determine methods for removing potentially harmful aerosols from the environment. (3) Determine possible altered toxicological behavior of aerosols. GRA

N72-23077# Stanford Univ., Calif. Information Systems Lab.
A REPRESENTATIONAL MODEL FOR THE ARTERIAL PRESSURE RECEPTORS OF THE CARDIOVASCULAR SYSTEM
V. Scott Borison Dec. 1971 122 p refs
(Contracts N00014-67-A-0112-0044; Grants PR-5353-09; HE-08696-07)
(AD-735961; SU-SEL-71-060) Avail: NTIS CSCL 06/16

Baroreceptors in the cardiovascular system are pressure transducers that provide a series of nerve impulses used by the central nervous system for control of blood pressure, distribution of blood flow, and body fluid balance. The study described in this thesis incorporates known facts and hypotheses about the receptor mechanism to develop a nonlinear mathematical model, based on physical principles, relating the pressure to the impulse activity. GRA

N72-23078# Army Medical Research Lab., Fort Knox, Ky.
MILLISECOND EXPOSURE OF PORCINE SKIN TO SIMULATED CO2 LASER RADIATION Final Report
Arnold S. Brownell, David K. Hysell, and Wordie H. Parr 22 Oct. 1971 20 p refs
(DA Proj. 3A0-61102-B-71-R)
(AD-735714; USAMRL-953) Avail: NTIS CSCL 06/18

To approximate the absorption of CO2 laser radiant energy by skin and the subsequent distribution of thermal energy in this tissue, the skin was painted with a thin layer of India ink and exposed to ruby laser radiation. The resulting lesions were examined and graded both visually and histologically. The median effective dose for minimal erythema was determined to be 0.8 joules/sq cm for an exposure time of 3.5 msec. Histologically measured depth of damage was determined for doses up to 2.8 joules/sq cm. It is concluded that the simulated experimental conditions are valid only for doses less than 1.4 joules/sq cm. GRA

N72-23079# Eye Research Foundation of Bethesda, Md.
THRESHOLD FOR PERMANENT FUNCTIONAL AND MORPHOLOGICAL VISIBLE DAMAGE IN HUMAN RETINAS USING VISIBLE RADIATION Final Report, 6 Jan. 1969 - 31 Dec. 1970
Stephen Elgin, David O. Robbins, and Carl R. Cavonius May 1971 45 p refs
(Contract F41609-69-C-0027; AF Proj. 6301)
(AD-735802; SAM-CR-71-2) Avail: NTIS CSCL 06/18

The energy densities required to produce ophthalmoscopically visible retinal burns in the periphery of the fundus were determined for six human Caucasian subjects. The thresholds for retinal burns in humans were significantly higher than those required to produce similar lesions in monkey or rabbit eyes and is probably related to the differential pigmentation and image size in the retinas of these species. Using a 3 degree spot size, the theoretical energy necessary to produce a visible burn in brown-eyed subjects was 4.5 cal/sq cm for a 1 sec. exposure. Exposure durations shorter than 1 sec. required less overall energy while those over 1 sec. required more. Threshold energies for two blue-eyed patients were significantly higher than those for brown-eyed patients and may also be related to the degree of pigmentation of the RPE. Functional studies of a macular burn case is reported. Author (GRA)

N72-23080# Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATIONS OF LASER SKIN HAZARDS Final Report, 16 Mar. 1970 - 11 Jan. 1971
John P. G. Williams, Stanley D. Carter, Kenneth J. Pavkov, and J. B. Boatman Jan. 1971 70 p refs
(Contract F41609-70-C-0024)
(AD-735794) Avail: NTIS CSCL 06/18

The report considers the effect of four lasers, the argon, the Q-switched neodymium, the carbon dioxide and the Q-switched ruby laser on human skin. Two Negro and two Caucasian volunteers were exposed to each laser. Each subject received 3 or 4 different dose levels of irradiation. These dose levels were preselected by the sponsor to explore the threshold of effect to produce minimal erythema and discomfort. After irradiation skin biopsies were taken in the first experiment - the argon laser - no change was seen immediately after exposure but some changes were evident 24 hours after the exposure. In subsequent experiments samples were taken 24 and 48 hours postirradiation. In general, changes in the skin structure were observed at 24 hours but these changes had generally disappeared at 48 hours postirradiation. Negro and Caucasian subjects were examined because the darker skin reflects less light and therefore absorbs more of the laser's energy. The degree of pigmentation was measured as reflectance prior to exposure to the laser. Author (GRA)

N72-23081# Stanford Research Inst., Menlo Park, Calif.
SOIL AS A SINK FOR ATMOSPHERIC CARBON MONOXIDE Final Report
R. B. Ingersoll Oct. 1971 47 p refs
(Contract CRC-APRAC-CAPA-4-68-(1-69))
(PB-205890; SRI-SCU-8799-F; CRC-APRAC-CAPA-4-68-3) Avail: NTIS HC $3.00 CSCL 06F

Because of the increased production of carbon monoxide from man's activities, it was considered important to study the biosphere's sink for it. The report describes studies conducted to determine if soils and vegetation could serve as a sink for atmospheric carbon monoxide. This was accomplished by exposing various soils and plant samples to experimental atmospheres containing carbon monoxide. The results show that higher plants tested had no detectable capacity for decreasing carbon monoxide, soils from a wide range of ecotypes depleted carbon monoxide, prolonged exposure of soil to carbon monoxide reduced the soil's capacity to deplete carbon monoxide, soils oxidize carbon monoxide to carbon dioxide, and carbon monoxide depleting microorganisms were identified. GRA

N72-23082# Texas Univ., Austin. Dept. of Psychology.
AUDITORY SIGNAL DETECTION AND RECOGNITION Final Scientific Report
James P. Egan 1 Dec. 1971 13 p
(Grant AF-AFOSR-1987-71; AF Proj. 9769)
(AD-736046; AFOSR-72-0183TR) Avail: NTIS CSCL 05/10

The research efforts were concerned with intensity discrimination, signal detection, and Type II receiver operating characteristics. Author (GRA)

N72-23083# Oregon Univ., Portland. Biophysics Lab.
APPLICATION OF ELECTRICAL CURRENT IN DENTAL ANESTHESIA AND ITS EFFECT UPON BONE FORMATION Annual Summary Report
Bhim S. Savara and R. Wayne Fields 27 Dec. 1971 27 p refs (Contract DADA17-70-C-0075)
(AD-736391) Avail: NTIS CSCL 06/5

The investigations are concerned with the use of applied electrical currents to instigate particular therapeutic effects. Major emphasis is being devoted to studies of the feasibility of using electrical currents as an agent to control orofacial pain. It has been tentatively demonstrated that electrical currents can interfere with cortical activity deemed of perceptual dependence in a manner similar to the attenuation of cortical responses induced by the analgesic agent nitrous oxide. In addition, an experimental series is being conducted to survey the currents, polarities, and field geometries of significance in the constructive modulation of tissue reparative processes. The work to date has demonstrated that artificial fields can modulate the architecture in both the fibrin clot and fibrous callus stages of initial healing. These results from both the orofacial electroanesthesia and fracture electrotherapeutics are encouraging and the studies are being extended. Author (GRA)

N72-23084# National Inst. for Occupational Safety and Health, Rockville, Md.
HEALTH ASPECTS OF SMOKING IN TRANSPORT AIRCRAFT
Dec. 1971 93 p Prepared jointly with FAA and Dept. of Transportation
(AD-736097) Avail: NTIS CSCL 06/5

The purpose of the study was to define the levels of certain combustion by-products of tobacco produced by passengers' smoking, to determine passengers' subjective reaction to tobacco smoke, and to obtain passenger opinion on the need for regulatory change regarding the control of smoking in commercial passenger airplanes. The study involved: (1) the collection of samples to determine the environmental exposure levels to carbon monoxide, particulate matter, polynuclear hydrocarbons, ammonia, and ozone, and (2) the use of a questionnaire during twenty Military Airlift Command (MAC) international flights and eight domestic flights. The results of environmental sampling revealed very low levels of each contaminant measured, much lower than those recommended in occupational and environmental air quality standards.
Author (GRA)

N72-23971# Naval Research Lab., Washington, D.C. Marine Biology and Biochemistry Branch.
EFFECTS OF POLLUTANTS ON GROWTH OF ALGAE
P. J. Hannan and Constance Patouillet *In its* NRL Progr. Rept. Feb. 1972 p 1-8 refs (See N72-23970 14-34)
Avail: NTIS HC $4.50

05 BIOTECHNOLOGY

Includes life support systems, human engineering, protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N72-23085* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ONE HAND BACKPACK HARNESS Patent
David F. Thomas, inventor (to NASA) Issued 14 Mar. 1972 7 p Filed 20 Feb. 1970
(NASA-Case-LAR-10102-1; US-Patent-3,649,921; US-Patent-Appl-SN-13266; US-Patent-Class-324-25A) Avail: US Patent Office CSCL 06K

A quick one handed device for donning and doffing gear carried in a backpack is described.
Official Gazette of the U.S. Patent Office

N72-23086*# Worcester Polytechnic Inst., Mass. Dept. of Chemical Engineering.
STUDY OF THE TECHNIQUES FEASIBLE FOR FOOD SYNTHESIS ABOARD A SPACECRAFT Final Report
Alvin H. Weiss 15 Mar. 1972 40 p refs
(Grant NGR-22-017-008)
(NASA-CR-126397) Avail: NTIS HC $4.00 CSCL 06H

Synthesis of sugars by Ca(OH)2 catalyzed formaldehyde condensation (the formose reaction) has produced branched carbohydrates that do not occur in nature. The kinetics and mechanisms of the homogeneously catalyzed autocatalytic condensation were studied and analogies between homogeneous and heterogeneous rate laws have been found. Aldol condensations proceed simultaneously with Cannizzaro and crossed-Cannizzaro reactions and Lobry de Bruyn-Van Eckenstein rearrangements. The separate steps as well as the interactions of this highly complex reaction system were elucidated. The system exhibits instabilities, competitive catalytic, mass action, and equilibrium phenomena, complexing, and parallel and consecutive reactions. Specific finding that have been made on the problem will be of interest for synthesizing sugars, both for sustained space flight and for large scale food manufacture. A contribution to methodology for studying complex catalyzed reactions and to understanding control of reaction selectivity was a broad goal of the project. Author

N72-23087# Joint Publications Research Service, Arlington, Va.
DEVELOPMENT OF A CYBERNETIC MODEL OF AN ANIMAL-ENVIRONMENT SYSTEM
K. K. Beer 4 May 1972 16 p refs Transl. into ENGLISH from Selskokhoz. Biol. (Moscow), v. 7, no. 1, 1972 p 25-32
(JPRS-55887) Avail: NTIS HC $3.00

An animal-environmental model, based upon the compliance of the organism to conditions of the environment according to the principle of bioecosis, is described. The concept of reloconstants in a biological model is used as well as equations of regression, which characterize the effect of different factors on cow milking, and which are of interest for plotting the entire mathematical apparatus of the model. Author

N72-23088# Ohio State Univ. Research Foundation, Columbus. Dept. of Psychology.
STUDIES OF PERFORMANCE IN COMPLEX AIRCREW TASKS Final Report
Harvey G. Shulman and George E. Briggs Dec. 1971 47 p refs
(Grant AF-AFOSR-1669-69; AF Proj. 9778; OSURF Proj. 2718)
(AD-735762; AFOSR-72-0156TR) Avail: NTIS CSCL 05/9

The basic objective of the research was the investigation of human performance under conditions of divided attention growing out of the requirement to divide attention between multiple information sources which is placed on operators of many modern man-machine systems. For example, performance under such conditions is normally required in the operation of an aircraft or in the process of controlling air traffic from the ground. The research is focused on performance in two types of divided attention paradigm designs, sequential and simultaneous. In a simultaneous demand situation, the operator is required to process at least two sources of information simultaneously. The sequential demand situation requires rapid alternation between at least two sources of information. GRA

N72-23089# Human Engineering Labs., Aberdeen Proving Ground, Md.
EXPERIMENTS UTILIZING COMMAND/CONTROL SIMULATOR. 1: ON-LINE PARTIAL DATA REDUCTION IN REACTION TIME EXPERIMENTS
C. Jane Davis Dec. 1971 32 p
(AD-736868; HEL-TN-5-71) Avail: NTIS CSCL 05/10

Reaction time experiments were conducted on a command/control simulator system. The system consists of three computer-driven displays with peripheral control devices. A program for on-line partial data reduction during experimental runs was developed. This program was written for the Varian 620I and is adaptable to similar mini-computers. Author

N72-23090# Fabric Research Labs., Inc., Dedham, Mass.
DEVELOPMENT OF THERMALLY DURABLE COATED FABRICS FOR USE IN FLIGHT GLOVES Final Report, Jul. 1969 - Dec. 1970
John Skelton and Ernest R. Kaswell Sep. 1971 86 p refs
(Contract F33657-70-C-0152)
(AD-737099; ASD-TR-71-47) Avail: NTIS CSCL 15/5

The flight gloves currently supplied to Air Force flight crew members provide softness, tactile response, gripping power and durability, but in contact with flame or in heated environments, their leather burns, shrinks violently, and becomes stiff and brittle. Because of potential danger, an effort is reported to develop materials with mechanical performance characteristics similar to those of leather, but which are flameproof and thermally stable. GRA

N72-23091# Naval Aerospace Medical Inst., Pensacola, Fla.
A SWEAT SENSOR FOR QUALITATIVE MEASUREMENTS
Joseph A. McClure, Efrain A. Molina, and Alfred R. Fregly 15 Nov. 1971 24 p refs
(AD-736922; NAMRL-1148; NAVMED-MR-041.01.01-0120B8FG-8) Avail: NTIS CSCL 06/2

To study objectively the sweat response during motion sickness, a need existed for a small sweat-sensing device with a short latency of response, a fast response time, and the ability to follow the time course of the sweat response. The design and function of a sweat-sensing device for continuous monitoring of the sweat response are described. A lithium chloride-aluminum chloride sensing element, which changes resistance depending on the uptake or release of moisture, is used in this sensor. The sensing element is enclosed in a housing that is designed to circulate air from the skin surface to the sensing element. Air is supplied from a compressed-air cylinder and is controlled with a needle valve flowmeter assembly. With an air-flow rate of 15 cc/min and in response to a step change in moisture content on the skin surface, the sensor has a latency of 1.5 seconds and a rise time to reach 90 percent of the saturation level of about 28 seconds. A major disadvantage of the sensor is that with heavy sweat rates, the sensing element saturates, resulting in relatively long 'drying out' times. This can be partially offset by using higher air-flow rates, but at the expense of reduced sensitivity. The application of this sensor has shown that it is capable of responding to the cyclic sweat activity commonly seen when skin-resistance measurement techniques are used to monitor the sweat response. Author (GRA)

N72-23092# Naval Medical Field Research Lab., Camp Lejeune, N.C.
DEVELOPMENT OF THE NMFRL TELEMETRY SYSTEM Interim Report
Wade G. Holcomb and Philip J. Rasch Feb. 1972 28 p refs
(AD-737111; NAVMED-MF12.524.007-8009B; IR-4) Avail: NTIS CSCL 06/2

The object was: (1) To devise a technique which will allow high-power radio telemetering of heart rate as detected by means of electrocardiogram skin electrodes, without being restricted by simultaneous electrocardiogram amplifier overload or saturation; (2) To design an electronic circuit which, when attached to an electrocardiogram amplifier, will allow the taking of an ECG without requiring readjustment for each body type. Author (GRA)

N72-23093# Naval Training Device Center, Orlando, Fla.
THE 25TH ANNIVERSARY COMMEMORATIVE TECHNICAL JOURNAL
G. Vincent Amico and James J. Regan Nov. 1971 253 p refs
(AD-735487) Avail: NTIS CSCL 05/9

Included are both the technical history of training devices and the issues which currently confront their design and use. These subjects are discussed by a group of distinguished scientists and engineers to commemorate a quarter of a century of progress in military training. A blend of human factors and engineering papers reflects the twin thrusts that make up the educational tools that are training device systems. Author (GRA)

N72-23094# American Inst. for Research, Pittsburgh, Pa.
DEVELOPMENT OF A TAXONOMY OF HUMAN PERFORMANCE: VALIDATION STUDY OF ABILITY SCALES FOR CLASSIFYING HUMAN TASKS
George C. Theologus and Edwin A. Fleishman Apr. 1971 98 p refs
(Contracts DAHC19-71-C-0004; F44620-67-C-0116; ARPA Order 1623)
(AD-736194; AIR-R71-10; AIR-726/2035-4/71-TR10; BESRL-Research-Study-71-9) Avail: NTIS CSCL 05/10

This report is the second of a series of studies designed to explore the feasibility of an approach to the development of a comprehensive taxonomy of tasks based upon the use of known parameters of human performance for describing and classifying tasks. The first report described the development of human abilities based rating scales and presented data on their reliability. The present report focuses on establishing preliminary estimates of the constructive and predictive validity of these scales. The validity data were obtained through judges' ratings of a set of 38 tasks on 37 ability rating scales. GRA

N72-23095# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EDUCATIONAL TECHNOLOGY PROGRAM Quarterly Technical Summary Report, 1 Sep. - 30 Nov. 1971
Frederick C. Frick 15 Dec. 1971 15 p
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-736030; ESD-TR-71-320) Avail: NTIS CSCL 05/9

The first three of the prototype terminals that will be used in the field tests at Keesler Air Force Base were completed and are being operated in full system shakedown tests. The microfiche production facility has been completed, and preparation and production of lesson materials for the Keesler Trial are proceeding on schedule. Author (GRA)

N72-23096# Singer-General Precision, Inc., Binghamton, N.Y. Link Div.
STUDY OF ADVANCED VEHICLE SIMULATION TECHNIQUES Final Report, Jul. 1970 - Apr. 1971
A. F. Collier, D. Peters, and R. G. Simpson Oct. 1971 419 p refs
(Contract N61339-70-C-0312)
(AD-736238; NAVTRADEVCEN-70-C-0312-1) Avail: NTIS CSCL 05/9

The report presents the results of a study to determine the feasibility of developing a visual simulation system for meeting the training requirements for operators of a variety of surface vehicles. The vehicles considered were a tank (MBT-70), an air cushion vehicle (SKMR-1), a hydrofoil (PC(H)-1) and an amphibious assault personnel carrier (LVTP-7). Included in the report is an analysis of the visual system requirements for these vehicles, a state-of-the-art investigation of visual system techniques, and the formulation of a recommended visual system. The recommended system combines a camera model approach for generating land scene with a scanned transparency approach for generating waves, the latter being inset into the land imagery. Author (GRA)

N72-23097# Life Sciences, Inc., Fort Worth, Tex.
ADAPTIVE TRAINING OF MANUAL CONTROL. 1: COMPARISON OF THREE ADAPTIVE VARIABLES AND LOGIC SCHEMES Final Report
Don A. Norman, Ann L. Lowes, and W. Guy Matheny Orlando,

Fla. Naval Training Device Center Jan. 1972 65 p refs
(Contract N61339-69-C-0156-1)
(AD-736621; NAVTRADEVCEN-69-C0156-1) Avail: NTIS CSCL 05/9

Gain-Effective Time Constant product (KT), System Compensation (SC) (a compensation of aiding and quickening) and Forcing Function Amplitude (FF) were compared as adaptive variables in an adaptive training experiment using 104 subjects. Comparison was also made of automatic and manual adjustment of the difficulty level determined by the level of the adaptive variable during training. Results showed KT to be slightly superior to FF as an adaptive variable while SC produced poor performance and a high rate of failure. Study of the results suggests that principles underlying KT and a correct form of SC can be used to develop an optimal method of shaping operator behavior. It was concluded that conventional concepts of aiding and quickening cannot be implemented as satisfactory adaptive variables. The results were additionally interpreted to indicate that logic for adjustment of difficulty level should utilize a performance measurement interval longer than 5 seconds.
Author (GRA)

N72-23067*# Research Triangle Inst., Durham, N.C.
FUTURE NEEDS FOR BIOMEDICAL TRANSDUCERS
F. Thomas Wooten *In its* Appl. of Aerospace Tech. in Biol. and Med. Dec. 1971 9 p refs Presented at Inst. of Elec. and Electron. Engr. Transducer Conf., Washington, D. C., 6 Oct. 1971
(See N72-23065 14-04)
Avail: NTIS HC $7.50 CSCL 06B

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectros copy). For applications see: 17 Materials, Metallic; 18 Mate rials, Nonmetallic; and 27 Propellants.

N72-23098*# Society of Automotive Engineers, Inc., New York. Bioenvironmental Systems Advisory Committee.
A STUDY OF ALTERNATIVE METHODS FOR RECLAIMING OXYGEN FROM CARBON DIOXIDE AND WATER BY A SOLID-ELECTROLYTE PROCESS FOR SPACECRAFT APPLICATIONS Final Report
Nov. 1971 24 p
(Contract NASw-2286)
(NASA-CR-126378) Avail: NTIS HC $3.25 CSCL 07D

Two alternative technical approaches were studied for application of an electrochemical process using a solid oxide electrolyte (zirconia stabilized by yttria or scandia) to oxygen reclamation from carbon dioxide and water, for spacecraft life support systems. Among the topics considered are the advisability of proceeding to engineering prototype development and fabrication of a full scale model for the system concept, the optimum choice of method or approach to be carried into prototype development, and the technical problem areas which exist.
Author

N72-23099*# Alabama Univ., University. Bureau of Engineering Research.
DEVELOPMENT OF A METHOD FOR THE DETERMINATION OF IODINE IN SPACECRAFT POTABLE WATER Final Report
George P. Whittle Mar. 1972 38 p refs
(Contract NAS9-11861)
(NASA-CR-115557; BER-147-14) Avail: NTIS HC $4.00 CSCL 07D

A one-reagent indicator solution has been prepared for the analysis of iodine concentrations in the range of 0.5 to 12 mg/1 of I2 for use on the potable water proposed for the Skylab project. The indicator solution was formulated to contain the minimum concentrations of reagents for optimum analytical performance. Performance tests indicated that the reagent is stable for at least six months and is reliable for the determination of I2 under a variety of conditions of I(-) concentrations and sample temperatures. Visual estimations as low as 0.5 mg/1 were obtained without difficulty and the stability of the developed color allows visual determinations from 0.5 to 12 mg/1 of I2 with a relatively small error.
Author

N72-23100*# California Univ., Berkeley. Sea Water Conversion Lab.
STUDY OF PERMEABILITY CHARACTERISTICS OF MEMBRANES Quarterly Report
K. S. Spiegler, R. J. Moore, J. Leibovitz, and R. M. Messalem 15 Jan. 1972 60 p refs Prepared for JPL
(Contract NAS7-100; JPL-952109)
(NASA-CR-126392; QR-15; QR-16) Avail: NTIS HC $5.00 CSCL 07D

A method is reported for evaluating transport experiments with membranes which is based on conservative fluxes, i.e. fluxes of quantities which do not vary across the membrane in the steady state. Conductance coefficients were calculated for the system: 0.05 N NaCl - C-103 cation-exchange membrane-0.1 N NaCl. It is concluded that this method can be used to characterize any system of the type - solution-membrane-solution.
F.O.S.

N72-23101# Lockheed Missiles and Space Co., Palo Alto, Calif.
MUTUAL SOLUBILITY OF CERTAIN INTERMEDIATE OXIDES OF TRANSITION METALS OF THE 4A AND 5A SUBGROUPS
V. A. Pereliaev and G. P. Shveikin [1971] 9 p refs Transl. into ENGLISH from Tr. Inst. Khim. Akad. Nauk SSSR Ural. Filial (Sverdlovsk), no. 20, 1970 P 47-54
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

It is shown that for the system TiO2-VO2, NbO2 the domain of existence of solid solutions is bounded although extensive, and complete mutual solubility is observed for the system Ti2O3-V2O3. In addition, solid solutions on the basis of cubic lattices of stochiometric titanium and vanadium monoxides are not formed, while compounds with a limited oxygen content possess a noticeable mutual solubility (up to 25%). The behavior of solid solutions in these systems was examined from the view point of a different valence composition for both the individual phases and its possible partial change during formation of solid solutions.
Author

N72-23102# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Werkstoff-Forschung.
THE ELECTROCHEMICAL ADSORPTION
H. Buhl Dec. 1971 42 p refs In GERMAN; ENGLISH summary
(DLR-FB-71-104) Avail: NTIS HC $4.25; DFVLR, Porz-Wahn: 13,80 DM

The adsorption phenomena are an important part in the stress corrosion cracking in aqueous and moist environment caused by chemisorption of ions out of aqueous electrolytes. For this electrochemical adsorption a basic relation has been derived from strictly thermodynamical foundations, and the quantities contained in this equation have been determined by conceptions based on the double layer of a model. A comparison of the results of this adsorption isotherm with the experiment shows a satisfying agreement. The reason for the deviation is the lack of accuracy in the calculation of the change in the free energy of the transition of the ion into the chemisorbed state.
Author

N72-23103# Rice Univ., Houston, Tex. Dept. of Chemistry.
STUDIES IN THE PHYSICAL CHEMISTRY OF SELECTED HIGH TEMPERATURE SYSTEMS Progress Report, 1 Dec. 1970 - 30 Nov. 1971
John L. Margrave and Philip R. Brooks 30 Nov. 1971 16 p

refs
(Contract AT(40-1)-2907)
(ORO-2907-83) Avail: NTIS HC $3.00

Mass spectra and matrix spectra were obtained for number of metal fluorides, (rare earth trifluorides, GeF2, EuF2); chlorides, (CCl2, CClBr, CCl3, CCl2Br, CClBr2, BaCl2, EuCl2, PbCl2, SrCl2, UCl2, CaCl2, ScCl2, TiCl2, VCl2, CrCl2, MrCl2, FeCl2 and NiCl2; sulfides, (Al2S, Ga2S, In2S, Tl2S, BS2, B2S3, Li2S), and various ternary species (LiCN, NaCn, KCN, HCN, oxysulfides). Heats of fusion, high temperature enthalpy increments and Cp were determined for liquid niobium and liquid zirconium. Measurements on silicon and iridium are in progress. Molecular beam studies are discussed for the reactions of oriented molecules and the reactions of molecules which were selectively excited to specific vibrational states. Author

N72-23104# Bendix Corp., Kansas City, Mo.
VOLATILE LOSS IN POLYSTYRENE FOAM
C. E. Roebuck and D. J. Fossey Oct. 1971 102 p
(Contract AT(29-1)-613)
(BDX-613-578) Avail: NTIS

The volatile loss of expanded polystyrene foam specimens of different densities aged at different temperatures was investigated. A stacked index exponential model was fitted to the data for each specimen, giving the percent volatile loss in terms of time and the initial volatile content for the indicated temperature. The corresponding time derivative of the fitted equation or rate of volatile loss contained a factor which correlated with the computed diffusivity of the specimen at each data point. Author

N72-23105# Kansas Univ., Lawrence. Dept. of Chemistry.
VAPORIZATION AND THERMODYNAMICS OF RARE EARTH SULPHIDES. PART 1: VAPORIZATION STUDY OF GADOLINIUM SULPHIDES. PART 2: ISOMOLECULAR SULFUR EXCHANGE REACTIONS OF RARE EARTH SULFIDES Ph.D. Thesis
Richard Li-Chuan Wu 8 Jul. 1971 521 p refs
(Contract AT(11-1)-1140)
(COO-1140-200-Pt-1-Pt-2) Avail: NTIS

Results are presented of studies conducted of the rare earth-sulfur systems. The investigation consisted of phases, crystal structures, vaporization behavior, thermodynamics, and electron impact phenomena. Author

N72-23106# California Univ., Los Angeles. School of Engineering and Applied Science.
COARSENING OF GRAIN BOUNDARY PRECIPITATES
A. J. Ardell Sep. 1971 34 p refs
(Contract AT(04-3)-34)
(UCLA-34-P-172-4; UCLA-ENG-7160) Avail: NTIS HC $3.75

Theories of the coarsening behavior of precipitates situated on high angle grain boundaries were extended to include the effect of precipitate volume fraction, phi. The theoretical distribution of particle sizes is shown to broaden as phi increases. The coarsening behavior of precipitates situated on a dislocation network, or low angle grain boundary, was also theoretically investigated. It is concluded that the time exponent will have a value between 1/4 and 1/5 whenever the particle radii and the dislocation spacing are of roughly the same order of magnitude. The coarsening rate is predicted to increase with increasing volume fraction and decreasing dislocation spacing (or increasing grain boundary misorientation). Within the framework of the approximations in the theory, the particle size distributions are shown to be independent of phi, but are predicted to broaden whenever the time exponent increases from 1/5 to 1/4. Author

N72-23107# Iowa State Univ. of Science and Technology, Ames.
LOW TEMPERATURE THERMAL EXPANSION OF COPPER AND NaCl M.S. Thesis
Charles Ransford Case, II Jan. 1972 84 p refs
(Contract W-7405-eng-82)
(IS-T-497) Avail: NTIS HC $6.25

The linear thermal expansions of pure copper, pure NaCl, and OH(-)doped NACL were investigated in the 2 to 30 K temperature range. The temperature-dependent expressions for the expansion coefficients for the pure samples are given; the uncertainties include those due to possible systematic errors in the measuring apparatus. The OH(-)-doped NaCl samples showed low temperature thermal expansion anomalies which are attributed to the large volume dependence of the ion's free energy as it tunnels quantum mechanically between equivalent rotational orientations in the hostion potential. The OH(-)ion is assumed to sit as a Cl(-) substitutional impurity In the host NACL structure. The tunneling model is supported by both the temperature dependence and relatively large magnitude of the expansion anomaly. The dilatometer used in obtaining the expansion data is described. Author

N72-23108# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
HIGH PRESSURE STUDY OF THE AFMR IN FeF2 AND THE LOCAL MODE IN MnF2:Fe 2(PLUS)
K. C. Johnson and A. J. Sievers Oct. 1971 6 p refs
(Contract AT(30-1)-2391)
(NYO-2391-134) Avail: NTIS

By examining the effect of hydrostatic pressure on the AFMR in FeF2 and the localized magnetic mode in MnF2:Fe(2+), as well as the pramagnetic resonance of ZnFe(2+), the pressure dependence of the exchange fields was deduced in FeF2 and MnF2:Fe(2+). The existence of two magnetic dipole active lines in the far infrared in ZnF2:Fe(2+) allows the identification of the pressure dependence of both D and E: the uniaxial and orthorhombic anisotropy constants. The assumption that delta D/delta p is constant in the series of three crystals enables us to determine the pressure dependence of the effective exchange constants in FeF2 and MnF2:Fe(2+). The validity of the constant anisotropy behavior assumption is discussed, with the conclusion that the exchange calculations for MnF2:F3(2+) are more reliable than those for FeF2. Author

N72-23109# California Univ., Berkeley. Lawrence Berkeley Lab.
MASS TRANSPORT AND POTENTIAL DISTRIBUTION IN THE GEOMETRIES OF LOCALIZED CORROSION
John Newman Nov. 1971 70 p refs Presented at U.R. Evans Intern. Conf. on Localized Corrosion, Williamsburg, Va., Dec. 1971
(Contract W-7405-eng-48)
(LBL-408; Conf-711205-2) Avail: NTIS

The principles of current and potential distribution and mass transfer in electrochemical systems are developed with a view toward their application in analyzing and understanding the processes of localized corrosion, such as pitting and corrosion in crevices, under deposits, and in regions near gas-liquid-solid contact. Author

N72-23110# Institut Franco-Allemand de Recherches, St. Louis (France).
DETERMINATION OF THE CONCENTRATION AND SIZE OF DUST AEROSOLS IN A CONTAINER [BESTIMMUNG DER KONZENTRATION UND PARTIKELGROESSE DES LUFTSTAUBES IN GESCHLOSSENEN RAEUMEN]
H. W. Koch and L. Philipp 23 Aug. 1971 25 p refs In GERMAN
(ISL-22/71) Avail: NTIS HC $3.25

To determine the particle sizes of natural aerosols, tobacco smoke and air flowing in a subsonic wind tunnel, several methods of dust collection were used, followed by optical and electron microscope techniques. A knowledge of the particle sizes in the aerosols was necessary because of their consequences on the accuracy of laser-Doppler gas flow velocity measurements. Grain size distribution and average grain size for the three aerosols are indicated. Author (ESRO)

N72-23111# General Electric Co., Santa Barbara, Calif. DNA Information and Analysis Center.
REACTION RATE DATA, NUMBER 29
Sep. 1971 30 p
(Contract DASA01-70-C-0035)
(AD-736989) Avail: NTIS CSCL 07/4

The report presents summaries of recent progress reports and other informal information of current interest in the reaction rate field. Some of the research abstracted covers the following topics: Fe and Al oxidation; Atmospheric reactions; Eclipse data; Excitation and ionization of N and O ions; Ir spectra of uranium oxide; Metal oxides in laser blowoff; Ion-ion neutralization; Collisions of heavy particles; Metal oxide; H(-) and D2 reactions; He(-) and N2 reactions; Band systems of NO(-); Airborne airglow; Attendance at VII International Conference on the Physics of Electronic and Atomic Collisions. GRA

N72-23112# Hull Univ. (England). Dept. of Chemistry.
KINETICS OF HYDROGEN-OXYGEN AND HYDROCARBON-OXYGEN REACTIONS Interim Report, Oct. 1968 - Oct. 1971
Robert R. Baldwin and Raymond W. Walker Oct. 1971 31 p refs
(Contract EOOar-0013-68; AF Proj. 9750)
(AD-737137; AFOSR-72-0384; TR; IR-1) Avail: NTIS CSCL 07/4

A summary is presented on the authors's research concerned with elementary reactions involved in combustion processes. Work has been concentrated into four main areas of investigation: A detailed analysis of the mechanism and velocity constants for the D2 - O2 reaction; Studies of the addition of small quantities of hydrocarbons and related compounds to slowly reacting H2 - O2 mixtures at 480 - 500 C; Studies of the oxidation of formaldehyde, acetaldehyde and propionaldehyde in the temperature range 400 - 540 C to provide information first on the reactions of alkyl radicals, and secondly on the reactions of HO2 radicals; and Studies of the decomposition of hydrogen peroxide in the presence of H2, and of CO, to give velocity constants for the reactions of OH radicals with H2O2 and with CO. Author (GRA)

N72-23113# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
STUDIES OF THE BREAKDOWN MECHANISMS OF POLYMERS. 6: THE THERMAL DECOMPOSITION OF POLYBENZOXAZOLES AND POLYBENZOTHIAZOLES Final Technical Report, Sep. 1969 - Sep. 1970
Gerhard F. L. Ehlers, Kurt R. Fisch, and Wilbert R. Powell Sep. 1971 51 p refs
(AF Proj. 7340)
(AD-736780; AFML-TR-71-116) Avail: NTIS CSCL 07/3

The report describes work on the thermal breakdown mechanism of aromatic-heterocyclic polymers. Described is the flash pyrolysis of model benzoxazoles and benzothiazoles, and the decomposition of polybenzoxazoles and benzothiazoles. Each polymer was decomposed stepwise in vacuum at two or three different temperatures, between 450 and 660 c. The gases were analyzed by mass spectroscopy. The residues were subjected to elemental analysis and infrared spectroscopy and overall breakdown mechanisms were postulated on the basis of the results. Author (GRA)

N72-23114# Fulmer Research Inst., Ltd., Stoke Poges (England).
HEATS OF FORMATION OF HALIDES Final Report, 1 Jan. 1970 - 31 Dec. 1971
P. Gross, C. Hayman, and M. C. Stuart 31 Jan. 1972 14 p refs
(Contract F61052-70-C-0021)
(AD-737375; R.163/44; AFOSR-72-0434TR) Avail: NTIS CSCL 07/4

The purpose of the research was the supply of the heats of formation of compounds of interest in rocket propellants. Experiments have been made to determine combustion of tungsten in saturated chlorine vapour. The technique is described. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N72-23115 New Mexico State Univ., University Park.
DESIGN OF AN OPTIMUM RADAR SIGNAL TO REJECT CLUTTER Ph.D Thesis
Dudley Cade Lancaster 1971 110 p
Avail: Univ. Microfilms Order No. 71-19135

A method of designing a specific radar signal to enhance the target return and subdue white noise and clutter is provided. This optimum signal may be found with the aid of a computer to the desired extent of clutter suppression. The proposed design technique calls for making the signal an Nth degree polynomial in time, t, and choosing the coefficients of t sup n so as to maximize the signal to noise ratio out of a correlation receiver. An example is presented in which a single scatterer lies near the range of the target such that the clutter is likely to enter and be processed by the receiver along with the signal return from the target. By applying the technique described above, the best signal is found to become narrower as the degree of the polynomial is increased. Unlike the impulse function, the Nth degree polynomial in t has a finite bandwidth. This bandwidth can be found from the frequency spectrum of the signal, so the frequency spectra are determined and compared for each of the optimum signals. Dissert. Abstr.

N72-23116 Houston Univ., Tex.
INTEGRATED SPIRAL ANTENNAS FOR AEROSPACE APPLICATIONS Ph.D. Thesis
H. Dean Cubley 1970 211 p
Avail: Univ. Microfilms Order No. 71-22702

The need for an optimized antenna system design for use as a basic building block in large aerospace phased arrays is discussed. The proposition is made that this optimized antenna system can be designed with solid state electronics integrated directly into the feed point of a multimode slow wave planar spiral antenna of either the Archimedean or equiangular variety. A development of the general characteristics of both Archimedean and equiangular multimode planar spiral antennas is given. The modal excitation characteristics of this type of antenna are investigated to show that the total field of multimode spiral antennas may be written as the weighted summation of the fields excited by the individual modes once the form of those mode fields was determined. A hybrid model of the mode fields is developed based on a modified combination of the ring radiator model and the anisotropic sheet model. Dissert. Abstr.

N72-23117*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
COMMUNICATIONS SYSTEMS CHECKOUT STUDY Final Report
W. G. Ginter Mar. 1972 223 p refs
(Contract NAS9-12089)
(NASA-CR-115556; MDC-G2909; DRL-T-675; DRD-SE-2717)
Avail: NTIS HC $13.25 CSCL 17B

The results and conclusions of an engineering study of Space Station communications subsystem checkout are reported. The primary purpose of the study is to recommend specific guidelines and constraints for the design and utilization of the communications subsystem leading to a practical and effective means of onboard checkout implementation. Major study objectives are as follows: (1) identify candidate communications

subsystem checkout concepts, (2) determine implementation impacts of feasible concepts, (3) evaluate practicality and effectiveness of alternative concepts, (4) propose baseline modifications to accommodate preferred concepts, and (5) recommend areas for additional investigation. In addition, study results are interpreted, where appropriate, in terms of their applicability to checkout of Shuttle-Orbiter communications subsystem. Author

N72-23118*# Michigan Univ., Ann Arbor. Radio Astronomy Observatory.
ANALYSIS OF TYPE 3 SOLAR RADIO BURSTS OBSERVED AT KILOMETRIC WAVELENGTHS FROM THE OGO-5 SATELLITE Final Scientific Report
Hector Alvarez Dec. 1971 301 p refs
(Contract NAS5-9099)
(NASA-CR-122393; UM/RAO-71-9) Avail: NTIS HC $17.25 CSCL 20N

Research was conducted to analyze the data on solar radio bursts obtained by the OGO-5 satellite. Since the wavelengths corresponding to the three lowest frequencies of observations exceeded one kilometer, the bursts detected in those channels were designated as kilometer-waves. The data search covered approximately 9200 hours between March 1968 and February 1970, and included the maximum of solar cycle No. 20. The study concentrated on 64 Type 3 solar radio events reaching frequencies equal or lower than 0.35 MHz. This selection criteria led to the choice of the most intense radio events. Measurements included: times of start, times of decay, and amplitudes of the 64 events. The consistency of the results, within the accuracy of the measurements, lends support to some of the assumptions made for the analysis, notably, the validity of the local plasma hypothesis, the constancy of the exciter particles velocity, and spiral shape of their trajectory. Author

N72-23119# Lockheed Missiles and Space Co., Palo Alto, Calif.
METHODS OF MEASURING THE COORDINATES AND VELOCITY OF TARGET MOTION
V. V. Grigorin-Riabov, ed. [1971] 17 p Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 14-39
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Methods for determining the position and velocity of moving radar targets are discussed for the signal parameters amplitude, frequency, and phase used in measuring lag time. The measurement methods considered include: range measurement, angular coordinates, radial velocity, and computational methods. F.O.S.

N72-23120# Lockheed Missiles and Space Co., Palo Alto, Calif.
RADAR SURVEY
V. V. Grigorin-Riabov, ed. [1971] 10 p Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 81-95
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Simultaneous and sequential radar surveys are considered. The fundamental characteristics of a sequential survey system are discussed, including the minimally admissible survey period, relative survey period, kinds of sequential scanning (flat beam, pencil beam, zigzag, helical, conical-translation), and programmed scanning. K.P.D.

N72-23121# Lockheed Missiles and Space Co., Palo Alto, Calif.
RADAR STATION OPERATING RANGE
V. V. Grigorin-Riabov, ed. [1971] 15 p Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 146-166
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The technical parameters which affect the operating range of a radar station are discussed. The operating range of a radar station is examined initially under the condition where the radar and the target are in free space with no influence from the earth's surface and atmosphere. Mathematical models are included to quantify the operating range for various conditions. The dependence of the relative change in the range of detection on the value of the probability of correct detection is analyzed. Author

N72-23122# Lockheed Missiles and Space Co., Palo Alto, Calif.
ACCURACY OF MEASURING THE TARGET COORDINATES AND RADIAL VELOCITY
V. V. Grigorin-Riabov, ed. [1971] 16 p Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsip Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 216-239
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The accuracy of radar equipment in measuring target coordinates and radial velocity is evaluated. The root-mean-square error and experimental methods are used for the analysis. E.H.W.

N72-23123# Lockheed Missiles and Space Co., Palo Alto, Calif.
THEORETICAL PRINCIPLES OF RADAR
V. V. Grigorin-Riabov, ed. [1971] 6 p ref Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 3-14
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The operational principles of radar equipment, their block diagrams, specific peculiarities of different purpose radar, and estimates of their fundamental indices are explored theoretically. Data are given for the principles of target detection and tactical data, and technical characteristics of a radar station. E.H.W.

N72-23124# Joint Publications Research Service, Arlington, Va.
OPTIMUM RECEPTION OF AN FM RADIO SIGNAL ON A BACKGROUND OF WHITE NOISE AND NARROW BAND AM JAMMING
Yu. N. Babanov and S. G. Manukyan 24 Apr. 1972 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (Kiev), v. 14, no. 12, Dec. 1971 p 1502-1508
(JPRS-55786) Avail: NTIS HC $3.00

An optimum radio receiving device was synthesized when the useful FM radio signal with a wandering phase is received on a background of normal narrow-band and white noises. A block diagram of an optimum receiving device is given, and the relationship is studied between the variation of the square of the relative error and the signal to noise ratio for different modulation indices. Data are given for a quasi-optimal receiver. Author

N72-23125# Bureau of Radiological Health, Rockville, Md. Div. of Electronic Products.
MEASUREMENT OF ELECTROMAGNETIC RADIATION LEVELS FROM SELECTED TRANSMITTERS OPERATING BETWEEN 54 AND 220 MHz IN THE LAS VEGAS, NEVADA, AREA
Kenneth R. Envall, Richard W. Peterson, and Harold F. Stewart Sep. 1971 87 p refs
(DHEW(FDA)-72-8012; BRH/DEP-72-4) Avail: SOD $0.75 CSCL 17B

Electromagnetic power levels were measured and compared with theoretical power levels from selected transmitters operating in the frequency range of 54 to 220 MHz in the Las Vegas, Nevada, area. The field measurements were made at 62 grid locations by means of calibrated dipole and biconical antennas. Power variations with respect to antenna height, time of day, distance from a grid point, angular dependence, and terrain were investigated. The data were evaluated in terms of observed and

theoretical power levels and converted to power densities for hazards analysis applications. The results indicate that estimates of theoretical power levels should serve as a satisfactory measure of population exposure to electromagnetic energy in the frequency range considered. Author

N72-23126# Joint Publications Research Service, Washington, D.C.
DUAL ANTENNA METHOD OF SUPPRESSING REFLECTIONS FROM UNDERLYING SURFACE
V. I. Kustov and M. B. Tenin May 1972 16 p refs Transl. into ENGLISH from Tr. Mosk. Aviats. Inst., Teoriya Tekh. Radiolokatsii (Moscow), no. 178, 1968 p 147-161
(JPRS-55908) Avail: NTIS HC $3.00

An attempt is made to solve the problems associated with high signal fluctuations in moving target indicators by the dual antenna method. The method employs two antennas, located on the lower part of the aircraft, which are connected alternately to a radar transmitter. The first antenna emits a sounding pulse from a certain point in space and receives the reflected signal. The signals are amplified, detected, and delayed for a time by a first receiver. The second antenna carries out the same function from the same point as the first antenna using a second receiver. The signals from the second antenna are then subtracted from the delayed signals of the first antenna thus compensating reflections from the underlying surface of the aircraft. E.H.W.

N72-23127# Lockheed Missiles and Space Co., Palo Alto, Calif.
RADAR SYSTEMS WITH ACTIVE RESPONSE
V. V. Grigorin-Riabov [1971] 10 p ref Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 654-666
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The properties of radar systems with active response are considered in the area of target recognition. Various radar recognition systems are discussed, including matched, autonomous, and combined systems. Signal coding methods and the capacity of a recognition system are also reviewed. K.P.D.

N72-23128# Illinois Univ., Urbana. Dept. of Computer Science.
SYNCHRONIZATION SYSTEM FOR A TELEVISION BANDWIDTH COMPRESSION SCHEME M.S. Thesis
Edward Ellis Carr Oct. 1971 20 p refs
(Contract AT(11-1)-1469)
(COO-1469-194; UIUCDCS-R-71-483) Avail: NTIS

The ORBIT (Online Reduced Bandwidth Information Transfer system) is designed to transmit black-on-white drawings with an average bandwidth compression of twenty-five to one. It consists of a transmitting section, fed by a standard TV camera, and a receiving section, coupled to a conventional monitor. Author

N72-23129# Sandia Labs., Albuquerque, N.Mex.
RADIO NOISE ENVIRONMENT OF SPACE
R. L. Chiburis Nov. 1971 23 p refs Sponsored by AEC
(SC-M-710766) Avail: NTIS

The total noise in a satellite radio receiver system arises from three major sources: internal, external natural, and external man-made. The most dominant sources of external terrestrial and extraterrestrial noise are galactic noise, solar noise, noise generated by lightning discharges, and man-made interference. The discussions concern the characteristics of these noise sources and estimates of the noise field strength and the noise flux density expected in a bandwidth of 1 MHz at altitudes of 40,000 and 100,000 km. Indications are that the radio emissions from man-made transmitters pose the most serious, most pervasive, and most recurrent interference threat to a satellite VHF receiver system. Author

N72-23130# Rome Univ. (Italy). School for Aerospace Engineering.
MEASURING METHODS AND INSTRUMENTS USED FOR THE OPERATIONAL CONTROL IN PHASE MODULATED TRANSMISSION SYSTEMS [METODI E STRUMENTAZIONE DI MISURA PER LA VERIFICA DELLE CONDIZIONI DI LAVORO NEI SISTEMI DI TRASMISSIONE A MODULAZIONE DI FASE]
Giorgio Ravelli Dec. 1970 59 p refs In ITALIAN; ENGLISH summary *Its* ATTI del Centro Ric. Aerospaziali No. 34
Avail: NTIS HC $5.00

Methods which can be used during the design and testing phases to measure the modulation characteristics of transmission systems employing low deviation phase modulated carriers are described. Fourier analysis is applied to carriers phase modulated by the more common signals in order to derive the power distribution over the frequency spectrum. The working principles and essential characteristics of the instruments are given.
Author (ESRO)

N72-23131# Transportation Systems Center, Cambridge, Mass. Transportation Systems Center.
BIBLIOGRAPHY ON GROUND VEHICLE COMMUNICATIONS AND CONTROL: A KWIC INDEX, VOLUME 2 Annual Report
W. I. Thompson, III Aug. 1971 193 p refs
(PB-204807; DOT-TSC-UMTA-71-13-Vol-2) Avail: NTIS HC $3.00 CSCL 17B

The bibliography covers the subject of communication and control of ground vehicles. This covers the fields of land-mobile communication, computer aided traffic control, communication with high speed ground vehicles, and radio frequency noise. Emphasis is placed on the 150, 450 and 900 MHz frequency bands. The bibliography has two indexes: a key work in context, KWIC index; and an author index. There are 1100 citations in the bibliography. Author (GRA)

N72-23132# System Development Corp., Santa Monica, Calif.
THE FOLDING QUEFRENCY OF THE CEPSTRUM Technical Report, Jul. - Dec. 1971
H. B. Ritea 5 Jan. 1972 17 p refs
(Contract DAHCI5-67-C-0149; ARPA Order 1327)
(AD-735968; SDC-SP-3632) Avail: NTIS CSCL 17/2

It is shown that the power spectrum of speech is symmetric about a quefrency, termed the folding quefrency. Various allowable combinations of number of dignitized samples and sampling times are given, which yield valid cepstra up to 20 msec. GRA

N72-23133# Lockheed Missiles and Space Co., Palo Alto, Calif.
RADAR OUTPUT UNITS WITH CONTINUOUS TARGET TRACKING
V. V. Grigorin-Riabov, ed. [1971] 15 p ref Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 307-328
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The fundamental principles for operating target tracking radar are outlined. Data cover automatic range tracking, automatic direction tracking, and automatic velocity tracking. Also discussed are potential and limiting accuracy. E.H.W.

N72-23134# Defence Research Information Centre, Orpington (England).
THE PARAMETERS OF A SLOT EMITTER ON A PI-WAVEGUIDE
V. A. Lyashchenko Jan. 1972 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron. (Ukrainia SSR) v. 14, no. 1, Jan. 1971 p 49-55
(AD-736185; DRIC-Trans-2551; BR30072) Avail: NTIS CSCL 09/5

The dependence of the coefficients of radiation and reflection

on the length of slot, on its orientation on the Pi-waveguide and on the critical and working length of a wave was investigated. Experimental verification of the results achieved was carried out.
Author (GRA)

N72-23135# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
AN EXPERIMENTAL DOPPLER RADAR AND ANTENNA POSITIONING SYSTEM FOR AFFDL 50-MW ELECTRO-GASDYNAMICS FACILITY Final Report, Sep. 1968 - Mar. 1971
H. W. Prinsen, R. H. Jarvis, and S. G. Margolis Jul. 1971 68 p refs
(Contract F33615-69-C-1018; AF Proj. 1426)
(AD-736826; CAL-UM-2712-E-1; AFFDL-TR-71-100) Avail: NTIS CSCL 17/9

A K sub a band CW high-resolution Doppler radar and antenna positioning system was designed, constructed and installed in the U.S. Air Force Flight Dynamics Laboratory 50-Megawatt Electrogasdynamics Facility. It was intended for use as a diagnostic tool in investigating and measuring electronic characteristics and velocity of ionized flow in the test section.
Author (GRA)

N72-23136# Lincoln Lab., Mass. Inst. of Tech., Lexington.
VIBRATION AND STRAIN-INDUCED NOISE FROM THE ELF FLEXIBLE LOOP ANTENNA
Jerome E. Manning 15 Dec. 1971 36 p refs
(Contract F19628-70-C-0230; AF Proj. 1508A)
(AD-737093; TN-1971-51; ESD-TR-71-321) Avail: NTIS CSCL 09/5

Measurements have been made on a segment of the ELF flexible loop antenna to study its electrical sensitivity to vibration and strain. Transfer functions for the output voltage resulting from various types of vibration and strain were determined as functions of frequency, bias current, and orientation with respect to the gravitational field. Based on these laboratory measurements, it is tentatively concluded that the principle source of noise for the flexible loop antenna towed from a submarine is longitudinal strain.
Author (GRA)

N72-23137# Naval Research Lab., Washington, D.C.
DIGITAL BANDPASS BEAMFORMING WITH THE DISCRETE FOURIER TRANSFORM Interim Report
David T. Deihl 26 Jan. 1972 31 p refs
(AD-737191; NRL-7359) Avail: NTIS CSCL 17/1

A method is developed to form beam spectral estimates from a set of signals sampled from hydrophone outputs of an acoustic array. The signals must be frequency band limited over an interval (Wo,Wo-W) and sampled over a time interval T. A savings of (Wo/W) 1 in data storage and computation time is realized over conventional beam forming analysis methods employing sampling rates equal to twice the highest frequency in the signal band. Any set of delays ti may be used and the beamforming error determined as long as ti-T/2. The computed beam spectra can be made arbitrarily close to the actual beam spectra by choosing (a) a large number of points to be analyzed, (b) small input signal amplitudes at the end points of the time interval T, and (c) small actual spectrum amplitudes near f-Wo and f-Wo-W. This procedure would be particularly applicable to future sonar systems employing digital circuitry to beamform and spectrum analyze on-line.
Author (GRA)

N72-23138# Naval Research Lab., Washington, D.C.
ON THE STATISTICS OF SEA CLUTTER Final Report
G. R. Valenzuela and M. B. Laing 30 Dec. 1971 39 p refs
(AD-737200; NRL-7349) Avail: NTIS CSCL 17/9

A model for the statistics of sea clutter has been developed from scattering theory and the composite surface-scattering model. The model postulates that sea clutter is exponentially (Rayleigh envelope) distributed for glassy seas and should tend toward the lognormal distribution (in particular for horizontal polarization) with increasing roughness. The lognormality of sea clutter arises from the tilting of the slightly rough patches by the large-scale roughness (undulating surface). An empirical identification of the statistics of sea clutter taken with the Four-Frequency Radar system shows that in general the distribution of sea clutter is intermediate between the exponential (Rayleigh envelope) and the lognormal distribution. However, for calm seas and small sample sizes (less than about 200 independent samples) the distribution of sea clutter may be approximated by either the exponential or the lognormal distribution. The first five central moments of sea clutter (in decibels) have been calculated for moderate and rough sea conditions.
Author (GRA)

N72-23139# Army Electronics Command, Fort Monmouth, N.J.
MODE LOCKED LASER COMMUNICATIONS SYSTEM
Martin I. Wolfe Oct. 1971 25 p refs
(DA Proj. 1H6-62701-A-448)
(AD-737179; ECOM-3492) Avail: NTIS CSCL 17/2

The report is intended to provide a brief outline of various possible designs for a high bit rate laser communications system. The concern is solely on using a mode-locked laser and pulse code modulation. For each proposed system, the advantages and disadvantages as well as foreseeable barriers are indicated. This report grew out of a study and investigation of mode-locked lasers and techniques for incorporating them in a laser communications system. Recommendations on the most feasible system for fabrication are given. This is based on the near term-component state-of-the-art as well as the requirements of a tactical system.
Author (GRA)

N72-23140# Army Foreign Science and Technology Center, Charlottesville, Va.
FROM MILLIHERTZ TO TETRAHERTZ: RADIO WAVES IN MARINE COMMUNICATION AND NAVIGATION
M. P. Dolukhanov Oct. 1971 20 p ref Transl. into ENGLISH from the monograph "Milligerts to Tetragerts: Radiovolny v Morskoi Svyazi i Navigatisii p 22-25, 49-50, 53-63 p 22-25, 49-50, 53-63
(FSTC Proj. T7023012301)
(AD-736914; FSTC-HT-23-49-72) Avail: NTIS CSCL 20/14

Classification of radio waves by their manner of propagation is discussed including the influence of the earth's magnetic field on this process. Radio waves of specific frequency ranges are also examined with special attention to the applications of ultralong waves for global communication, systems of remote navigation, and communication with submerged submarines.
Author (GRA)

N72-23141# Raytheon Co., Wayland, Mass. Equipment Development Labs.
MODIFICATIONS TO THE COHERENT MEMORY FILTER FOR THE PORCUPINE C-BAND PULSE DOPPLER RADAR Final Report, 15 Oct. 1970 - 15 Oct. 1971
Roy E. Byington Nov. 1971 89 p refs
(Contract F19628-71-C-0021)
(AD-737360; AFCRL-71-0575) Avail: NTIS CSCL 17/9

The report describes the modifications performed to the Raytheon designed Coherent Memory Filter (CMF). The most significant modification was the addition of an operator selectable high prf mode of operation. The CMF was initially designed with a prf of 917 pps which, at C-band, resulted in an unambiguous velocity of 25 meters per second. The modification introduced an additional prf of 1760 pps and a corresponding 48 meters per second unambiguous velocity. Complete operating and alignment procedures are presented along with two appendices to aid in understanding the principles of operation of the CMF.
Author (GRA)

N72-23142# Air Force Cambridge Research Labs., L. G. Hanson Field, Mass.
PHASE, PHASE SIGNATURE, AND SIMPLE INVERSE PROPERTIES OF BACKSCATTERED FIELDS FROM THIN

RODS
Richard B. Mack 4 Oct. 1971 54 p refs
(AF Proj. 5635)
(AD-736757; AFCRL-71-0526; AFCRL-PSRP-465) Avail: NTIS CSCL 17/9

Numerical and analytical methods are used to examine properties of the phase of backscattered fields from perfectly conducting thin rods as functions of both aspect angle and frequency. Emphasis is placed on special conditions under which the phase is simply related to the body length and thickness. Calculated results are shown to be in good agreement with measured ones. Implications of the phase properties for dual frequency phase signatures are discussed and examples given. The amplitude of the backscattered field is shown to have a frequency-dependent shape that is essentially independent of aspect angle through the first resonant maximum. Measurement procedures that might be used to separately determine rod thicknesses and lengths are suggested. Author (GRA)

N72-23143# Avco Corp., Cincinnati, Ohio. Electronics Div.
RADIO SET AN/PRC-70 Quarterly Report, 1 Jul. - 1 Oct. 1971
C. A. Bucher Dec. 1971 46 p
(Contract DAAB07-71-C-0319)
(AD-736858; Rept-80045-PRC-33/1271; ECOM-0319-1; QR-1) Avail: NTIS CSCL 17/2

The report covers the development work on the AN/PRC-70 HF/VHF Radio Set for manpack usage. The report covers the results of trade-off studies in the areas of the tuner, synthesizer, and power amplifier. A summary of the design approach and breadboard activities is included. Author (GRA)

N72-23144# Air Force Human Resources Lab., Williams AFB, Ariz. Flying Training Div.
EVALUATION OF AN AIRBORNE AUDIO-VIDEO RECORDING SYSTEM FOR AIRCRAFT EQUIPPED WITH HEAD-UP DISPLAY
Joe A. Fitzgerald May 1971 19 p refs
(AF Proj. 1123)
(AD-736818; AFHRL-TR-71-20) Avail: NTIS CSCL 05/9

The objective of the project was to provide a low-cost, reliable audio-video recording system (AVRS) for aircraft equipped with Head-Up Display (HUD) that would be capable of recording both the external real world cues through the aircraft's forward windscreen as well as the symbology of the HUD projected on the aircraft's combining glass. The ultimate objective is a research program to assess audio-video recording in HUD-equipped aircraft as both technique for improvement of training and as a tool for pilot proficiency assessment. Two A-7D aircraft were fitted with an AVRS constructed from low-cost, commercial equipment with a good record of reliability. The equipment was modified to make it compatible with the aircraft and its flight environment. The system proved capable of recording the symbology on the HUD, as well as resolving ground targets at normal altitudes and slant ranges encountered in the training environment. Author (GRA)

N72-23145# ITT Gilfillan, Inc., Van Nuys, Calif.
PHASE LOCKED BULK OSCILLATOR ARRAY Final Technical Report, 31 Aug. 1970 - 31 Sep. 1971
Curtis A. Newkirk and James C. Polk Dec. 1971 268 p refs
(Contract F30602-70-C-0071)
(AD-736821; RADC-TR-71-284) Avail: NTIS CSCL 17/9

Work pursued was intended to demonstrate the ability of frequency locked bulk effect sources to operate as distributed transmitter sources for a solid state radar system. A module design was evolved consisting of the bulk oscillator, its modulator, a transmit-receive switch, 6 bits of phase control, associated logic circuitry, and a polarization diverse radiator. A linear array of 16 such modules was constructed and evaluated. Additionally, the linear array was utilized as the transmitter-antenna of a solid state phased array radar system. The SPAR system detected stationary targets at ranges up to 11.5 kilometers and light aircraft at 3 kilometers. Author (GRA)

N72-23146# Duke Univ., Durham, N.C.
COHERENT TRANSPONDER SPECIFICATION AND RECOMMENDATION FOR ITS BENCH TESTING
J. L. Henry, Sidney Kazel, J. S. Lambert, and R. D. Mitchell Dec. 1971 102 p refs
(Contract DA-31-124-ARO(D)-119)
(AD-736877) Avail: NTIS CSCL 17/9

A study was made to define the specification relating to the coherency of a coherent transponder. The panel, on the basis of information which was available, studied the problem. Recommendations were made on the following: Definition of coherency as applied to the transponder; Specification defining the coherency of the transponder in terms of the transponder parameters; Test circuits to be used to evaluate the transponder coherency characteristics; The derivation of an expression relating the frequency error with the phase error of the transponder. Two different circuits for the evaluation of the transponder coherency characteristics are suggested, one for use with the AN/FPS-16(AX), the other for use with the AN/MPS-36. Author (GRA)

N72-23147# Army Electronics Command, Fort Monmouth, N.J. Research and Development Technical Report.
EXPLOITATION AND PERFORMANCE OF FOREST TREES AS ANTENNAS FOR RADIO COMMUNICATIONS IN DENSE FOREST COVERED TERRAINS SYNOPSIS OF LEBANON STATE FOREST, N.J. EXPERIMENTS
Nov. 1971 30 p ref
(DA Proj. 1H6-62701-A-448)
(AD-737308; ECOM-3508) Avail: NTIS CSCL 09/5

A new approach for the solution of the problem associated with the transmission of electromagnetic energy in dense forests was conceived and successfully demonstrated in field experiments. In actual testing in dense vegetation, forest trees coupled with a toroidal Hybrid Electromagnetic Antenna Coupler (HEMAC) showed themselves to be superior in performance to a vertical whip antenna. The analysis of the data compiled indicate that the signal emitted thru the use of a HEMAC in a forest duct decays as $1/r$ and $1/\sqrt{r}$ which indicates the existence of both space and surface wave modes. Author (GRA)

N72-23148# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A MODEL FOR ELF NOISE
James W. Modestino 16 Dec. 1971 29 p refs
(Contract F19628-70-C-0230; AF Proj. 1508A)
(AD-737368; TR-493; ESD-TR-71-322) Avail: NTIS CSCL 20/14

A model for ELF atmospheric noise is proposed and studied in detail. The model is completely described by a few meaningful parameters which are easily correlated with measured data. Procedures for fitting the free parameters to observed noise data are provided. The model should prove useful in the analysis and design of communication systems operating in impulsive noise environments. Author (GRA)

N72-23149# Lincoln Lab., Mass. Inst. of Tech., Lexington.
MULTIPLE-PULSE MONOPULSE ACCURACY
Dennis H. Pruslin 19 Nov. 1971 39 p refs
(Contract F19628-70-C-0230; AF Proj. 627A)
(AD-737369; TR-487; ESD-TR-71-302) Avail: NTIS CSCL 17/9

The report presents results from a simulation of an amplitude comparison monopulse system employing pulse integration (multiple pulses). Maximum-likelihood-angle estimators and approximations to them are derived. The accuracies (precision and bias) of these estimators are obtained by computer simulation for coherent and incoherent processing, and targets located on- and off-boresight. Results are presented as functions of signal-to-noise ratio and number of pulses integrated. The effects of imperfect knowledge of target doppler, phase, and amplitude are included. Theoretical bounds on the precision of the estimators are derived and compared with the simulation results. Author (GRA)

N72-23150# Admiralty Surface Weapons Establishment, Portsmouth (England).
AN EXAMINATION OF A GENERAL ASSOCIATION FORMULA FOR SIMPLE SITUATIONS
W. McCullagh Sep. 1971 36 p ref
(AD-737088; ASWE-TR-71-29; BR27903) Avail: NTIS CSCL 17/9

The results of applying a formula for calculating the probability of association between an observation and a forecast target position are examined for simple situations in which there is a single measurement and a single forecast. It is shown that in general none of the formula parameters can safely be ignored. In particular it is shown that the orientation and shape of the position error distribution ellipses is of great importance in the calculation of the probability of association. Author (GRA)

N72-23151# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE THEORETICAL PRINCIPLES OF THE ORGANIZATION OF INFORMATION SYSTEMS
Juliusz Lech Kulikowski 30 Nov. 1971 18 p refs Transl. into ENGLISH from Arch. Automat. Telemech (Warsaw); v. 15, no. 4, 1970 p 441-453 Presented at the Inform. Sci. Day, 8 May 1970, part of the Symp. on The Theory of Large Systems and Their Appl., Jablonna, Czechoslovakia, 4-9 May 1940
(AD-735642; FTD-HC-23-1507-71) Avail: NTIS CSCL 05/1

The article presents a survey of the theoretical problems connected with the organization and design of systems for processing and transmitting information. It gives a definition of information systems (IS) and classifies them from various points of view. It discusses briefly the most important aspects of the organization of IS, such as physical structure, functional structure, software, and operating principles. It presents certain problems connected with estimating the value of information supplied to its users by an IS. In a supplement it gives an example of the solution of the problem of optimum distribution of information in mass memory units of an IS, based on methods of integer programming. Author (GRA)

N72-23152# Naval Electronics Lab. Center for Command Control and Communications, San Diego, Calif.
TRANSFER OF INFORMATION ON NAVAL VESSELS VIA FIBER OPTICS TRANSMISSION LINES Research and Development Report, Jul. 1970 - Jan. 1971
H. F. Taylor 1 Jan. 1972 53 p refs
(NELC Proj. Z237; ZFXX512001)
(AD-736613; NELC-TR-1762-Rev-1) Avail: NTIS CSCL 17/2

Optical and electrical systems of intraship information transfer are compared with respect to cost and performance. Optical systems are shown to offer advantages over electrical for point-to-point links in which security and/or wide bandwidth are required. It is indicated that wide-bandwidth terminals can be built with commercial solid-state components for less than $100. The author recommends continued research in the area of optical integrated circuits and the development of military specifications for optical transmission lines and terminals. Author (GRA)

N72-23321# Sperry Rand Corp., Washington, D.C. Univac Div.
SPACE COMMUNICATIONS
Carl Hammer *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 175-195 (See N72-23307 14-13)
Avail: SOD $1.25

N72-23339*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETOSPHERIC RADIO NOISE
Michael Kaiser *In its* Significant Accomplishments in Sci., 1970 1972 p 75-80 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23353*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOCATIONS OF SOLAR RADIO BURSTS
Richard Fitzenreiter *In its* Significant Accomplishments in Sci., 1970 1972 p 149-153 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23397*# Scripta Technica, Inc., Washington, D.C.
RESULTS OF MEASUREMENT OF RADIO WAVE ABSORPTION IN THE IONOSPHERE BY THE AI METHOD
N. A. Korinevskaya *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 99-112 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 17B

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N72-23153*# System Development Corp., Santa Monica, Calif.
ANALYSES OF REQUIREMENTS FOR COMPUTER CONTROL AND DATA PROCESSING EXPERIMENT SUBSYSTEMS. VOLUME 1: ATM EXPERIMENT S-056 IMAGE DATA PROCESSING SYSTEM TECHNIQUES DEVELOPMENT
15 Mar. 1972 82 p refs
(Contract NAS8-25471)
(NASA-CR-123573; TM-(L)-HU-033/005/00-Vol-1) Avail: NTIS HC $6.25 CSCL 09B

The solar imaging X-ray telescope experiment (designated the S-056 experiment) is described. It will photograph the sun in the far ultraviolet or soft X-ray region. Because of the imaging characteristics of this telescope and the necessity of using special techniques for capturing images on film at these wave lengths, methods were developed for computer processing of the photographs. The problems of image restoration were addressed to develop and test digital computer techniques for applying a deconvolution process to restore overall S-056 image quality. Additional techniques for reducing or eliminating the effects of noise and nonlinearity in S-056 photographs were developed.
Author

N72-23154*# System Development Corp., Santa Monica, Calif.
ANALYSES OF REQUIREMENTS FOR COMPUTER CONTROL AND DATA PROCESSING EXPERIMENT SUBSYSTEMS. VOLUME 2: ATM EXPERIMENT S-056 IMAGE DATA PROCESSING SYSTEM SOFTWARE DEVELOPMENT
15 Mar. 1972 136 p
(Contract NAS8-25471)
(NASA-CR-123572; TM-(L)-HU-033/006/00-Vol-2) Avail: NTIS HC $9.00 CSCL 09B

The IDAPS (Image Data Processing System) is a user-oriented, computer-based, language and control system, which provides a framework or standard for implementing image data processing applications, simplifies set-up of image processing runs so that the system may be used without a working knowledge of computer programming or operation, streamlines operation of the image processing facility, and allows multiple applications to be run in sequence without operator interaction. The control system loads the operators, interprets the input, constructs the necessary parameters for each application, and cells the application. The overlay feature of the IBSYS loader (IBLDR) provides the means of running multiple operators which would otherwise overflow core storage. Author

N72-23155*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
THE LUNAR SCIENCES NATURAL LANGUAGE INFORMATION SYSTEM
W. A. Woods and R. M. Kaplan Sep. 1971 321 p refs Prepared for Language Res. Foundation
(Contract NAS9-11157)
(NASA-CR-115428; BBN-2265) Avail: NTIS HC $18.25 CSCL 09B

Because the lunar samples brought back from the Apollo moon missions have been obtained at great expense, it is especially important to make the analyses of these samples as widely available as possible and to maintain a central repository and data base of the results of this research. The Lunar Receiving Laboratory of the Manned Spacecraft Center, is collecting and maintaining a data base of such information and is taking steps to make this information available to lunar scientists through direct on-line access. Because of the importance of having a direct scientist-machine interaction, MSC has decided to adopt natural English as the input language for queries and updates to this data base. The Lunar Science Natural Language Information System (LSNLIS) is a prototype system for providing this type of interaction. Author

N72-23156*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AUTOMATED TESTING DATA REDUCTION COMPUTER PROGRAM
C. C. Chamis, J. Kring, and T. L. Sullivan 1972 18 p refs Presented at Conf. on Analysis of Test Methods for High Modulus Fibers and Composites, San Antonio, 12-13 Apr. 1972; sponsored by Am. Soc. for Testing and Mater.
(NASA-TM-X-68050; E-6894) Avail: NTIS HC $3.00 CSCL 09B

The capability of a computer program which can be part of a larger computer program for a fully automated multiaxial testing facility is described. The program was designed to process test data from tubular or flat specimens made from isotropic or anistropic materials, including high modulus fiber composites. Data from a large number of strain gages and combinations of applied loads can be used. Options are provided for single element, 90-degree, rectangular or Delta rosettes, or any combinations of these types of strain gages. Options are provided for strain gage transverse sensitivities. The program outputs include: structural axes strains and stresses, initial and strain-dependent elastic constants, shift of principal strain direction with load, and local curvatures from back-to-back strain gages, and either Calcomp or microfilm plots. The computer program is described with respect to its flow chart, input/output, embedding or linking with other programs. Author

N72-23157*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROGRAM DOCUMENTATION STANDARDS
Donald A. Parker and Clinton A. Frum (Computer Sci. Corp., Silver Spring, Md.) Mar. 1972 34 p
(NASA-TM-X-65874; X-564-72-65) Avail: NTIS HC $3.75 CSCL 09B

A style manual is presented to serve as a reference and guide for system and program documentation. It is intended to set standards for documentation, prescribing the procedures to be followed, format to be used, and information to be produced. The standards for program documentation specify the extent to which the programmer should support his efforts in writing. The first three sections of the manual (system, program, and operation descriptions) contain information of particular interest to management, operators, and program users, respectively. Each section was designed as a self-sufficient description from the management, operator, or user point of view. Author

N72-23158# Laboratoire d'Automatique et de Ses Applications Spatiales, Toulouse (France).
OPERATIONS MANUAL FOR THE SUBROUTINE ESTMC/1 [DOSSIER D'UTILISATION: SOUS-PROGRAMME ESTMC/1]
C. Hernandez Feb. 1972 15 p In FRENCH
(LAAS-AS-72-I-04) Avail: NTIS HC $3.00

A computer subroutine for the determination of the parameters in a multidimensional linear system by the least squares method, is described. Author (ESRO)

N72-23159# Logicon, Inc., San Pedro, Calif.
THE ADVANCED TARGETING STUDY, PHASE 1F. VOLUME 5: SPACE PROGRAMMING LANGUAGE (MARK 2) COMPILER. PART A: PROGRAM DESCRIPTION Final Report, Mar. 1970 - Jun. 1971
Richard E. Kayfes, William C. Nielsen, and Bruce W. Walker Los Angeles AF Sta., Calif. SAMSO Aug. 1971 634 p
(Contract F04701-70-C-0057)
(AD-735618; CS-7140-R0202-Pt-A; SAMSO-TR-71-124-Vol-5-Pt-A) Avail: NTIS CSCL 09/2

The document describes the installation and operation of a compiler for SPL/MARK II (Space Programming Language/Mark II). The compiler produces assembly code for the Honeywell HDC-701P aerospace computer. It is written in SPITBOL and executes on the IBM System/360 Model 65 or compatible System 360/370 computer. Author (GRA)

N72-23160# Analytics, Inc., Arlington, Va.
AN INVESTIGATION INTO SOFTWARE STRUCTURES FOR MAN/MACHINE INTERACTIONS Final Technical Report
Richard M. Nicholson, Bryan D. Wiggans, and Carl A. Silver Feb. 1972 88 p
(Contract N00014-71-C-0283; NR Proj. 196-103)
(AD-737266) Avail: NTIS CSCL 09/2

The current trend in command and control/information systems within the Navy, toward greater use of interactive capabilities, has the effect of bringing the true 'user'--the decision-maker--into direct contact with the system, rather than using a programmer as an intermediary. It is therefore necessary that the system designer orient the man/machine communication less toward his own programming community and more toward a user whose familiarity with computer devices and terminology is somewhat less than his own. For a clear view of the typical user and the functions he and the system perform, a survey of recent Navy systems is described. A review of the literature in information systems to determine the availability of information useful to the system designer in interactive software performance is presented. Finally, a research program to derive the needed information is proposed. Author (GRA)

N72-23161# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DIGITAL LOGIC SIMULATOR M.S. Thesis
John R. Niederhauser Dec. 1971 162 p refs
(AD-736827; GE/MA/72-1) Avail: NTIS CSCL 09/2

Digital Logic Simulator (DLS) is a CDC 6600 computer program which simulates synchronous and asynchronous networks of digital logic elements. It is used at the Air Force Institute of Technology to verify digital logic designs. DLS uses a state variable model which associates time delays with all elements. Thus, the effects of propagation delays on circuit behavior can be analyzed. DLS has four operation modes which allow the user to test circuits at various levels of complexity. A complete users manual is included in the thesis which describes the detailed features, capabilities, and language specifications for DLS. Author (GRA)

N72-23162# Aerospace Corp., El Segundo, Calif. Office for Technology.
ECONOMICS OF RELIABILITY FOR SPACECRAFT COMPUTERS, APRIL - SEPTEMBER 1971
H. Hecht 8 Oct. 1971 38 p refs
(Contract F04701-71-C-0172)
(AD-736760; TR-0172(2315)-1; SAMSO-TR-71-327) Avail:

NTIS CSCL 09/2

To achieve an economically optimum level of reliability each improvement step is warranted only if the expected reduction in cost of failure exceeds the cost of the improvement. To this end, techniques for calculating cost of failure are described, in particular a new technique for evaluating cost of failure for long-time spacecraft missions. Guidelines for assessment of the economic impact of various improvement techniques are presented. Author (GRA)

N72-23163# Ballistic Research Labs., Aberdeen Proving Ground, Md. Exterior or Ballistics Lab.

THE BRL WIND TUNNEL HIGH SPEED ANALOG-TO-DIGITAL DATA ACQUISITION SYSTEM

Lyle D. Kayser Dec. 1971 29 p

(RDT/E Proj. 1-I262301-A-201)

(AD-737180; BRL-MR-2142) Avail: NTIS CSCL 09/2

The report describes the capabilities of the BRL wind tunnel high speed analog-to-digital data acquisition system. The system contains 50 analog channels and 20 digital channels and acquires data sequentially at a rate of 12,000 samples per second. Data may be recorded on magnetic tape, punched paper tape, or flexowriter tabulations. The system has several modes of operation such as continuous, periodic scan, and single scan modes. This report is intended to give the program engineer or any user a concise description of the system and its functions. GRA

N72-23164# Naval Research Lab., Washington, D.C.

ANOTHER ASSOCIATIVE PROCESSOR Interim Report

John E. Shore and Terry L. Collins 30 Dec. 1971 23 p refs

(NRL Proj. R06-41)

(AD-737188; NRL-7348) Avail: NTIS CSCL 09/2

The logical design of an associative processor (AP), which has evolved from the design previously reported in NRL Report 6961, has now been oriented toward the requirements of the Advanced Avionic Digital Computer (AADC) under development by the Naval Air Systems Command. The AP is a bytevariable processor with multifield search, arithmetic, and logical capability. Data flow within the AP is a vertical trickle. Data for each word is fed in from the word above and fed out to the word below. The output may be the same as the input (functionally equivalent to broadcast), may be the contents of the word itself, or may be some function of the input and the word contents. A CMOS hardware implementation of the AP design is being tested, and preliminary results indicate that some hardware revisions will be necessary. Questions of AP control have been considered, and the details will be worked out through use of a software simulation. Author (GRA)

N72-23165# Martin Marietta Corp., Orlando, Fla.

HYBRID ANALYSIS IN THE DOMAIN OF SCIENTIFIC INVESTIGATION Final Report, 1 Jul. 1970 - 30 Jun. 1971

John L. Stricker, Morris J. Bodoia, Bill E. Burkett, William M. Howell, Daniel N. Shaffer, Hans L. Steinmetz, and Ted D. Ackley Jul. 1971 128 p refs

(Contract F19628-70-C-0301)

(AD-737359; OR-11332; AFCRL-71-0433) Avail: NTIS CSCL 09/2

An improved Ray Tracing Hybrid Computer Program is described that determines ray paths in three dimensions. The program determines the firing azimuth and elevation angles necessary to direct a ray to a desired target location. An improved Satellite Orbital Simulation Model that predicts the lifetime of a spherical satellite is presented. A Fourier Data Analysis Program developed to operate on an EAI 8400 digital system with 32K of core memory is described. The Cooley-Tukey East Fourier Algorithm is utilized to generate either the autospectrum of a time series or the cross correlation function of two time series. A hybrid computer program to provide solutions to partial differential equations describing seismic phenomena is discussed. An attempt is made to take the classic hybrid techniques for handling parabolic partials and extend them to provide solutions to the more complex hyperbolic partials. A stable but rather inaccurate hybrid model is described and several techniques for potential improvements are discussed. Author (GRA)

N72-23166# Texas Univ., Austin. Electronics Research Center.

FAULT DETECTION AND LOCATION IN SEQUENTIAL CELLULAR ARRAYS

Chia-Hsiaing Sung and C. L. Coates 5 Jul. 1971 80 p refs

(Contract F44620-71-C-0091; AF Proj. 4751)

(AD-736765; TR-106; AFOSR-71-2625TR) Avail: NTIS CSCL 09/2

The Covering Condition (enabling the application of necessary tests on all cells in an array) and the Existence of Sensitized Path Condition (enabling the propagation of the effect of a faulty cell to some boundary output) for the testability of combinational cellular arrays of rectangularly and unilaterally interconnected cells are analyzed separately in the paper. Author (GRA)

N72-23167# Stanford Research Inst., Menlo Park, Calif. Augmentation Research Center.

NETWORK INFORMATION CENTER AND COMPUTER AUGMENTED TEAM INTERACTION Interim Technical Report, 8 Feb. 1970 - 8 Feb. 1971

Douglas C. Engelbart 30 Jun. 1971 106 p refs

(Contract F30602-70-C-0219; ARPA Order 967; AF Proj. 0967)

(AD-737131; SRI-ARC-8277; RADC-TR-71-175) Avail: NTIS CSCL 09/2

The research reported is aimed at the development of online computer aids for augmenting the performance of individuals and teams engaged in intellectual work, and the development of the Network Information Center for the ARPA Computer Network. The report covers hardware and software development, applications in several areas, and a summary of plans for the continuation of the research during 1971. Author (GRA)

N72-23168# University of Southern Calif., Los Angeles. Behavioral Technology Labs.

A GENERAL PURPOSE ASCII DECODER FOR CONTROL OF PERIPHERAL DEVICES FOR CAI TERMINALS

Joseph W. Rigney and Louis A. Williams Jan. 1972 57 p

(Contract N00014-67-A-0269-0012; NR Proj. 154-295)

(AD-737324; TR-69) Avail: NTIS CSCL 09/2

The ASCII decoder described in the report accepts inputs from an acoustic coupler, or Modem, in a remote time-sharing system. On receipt of a special command character the decoder recognizes, stores and decodes the next two decimal digits. The output can be used to access any one of 100 items. For example, the decoder allows a random-access slide projector to be operated under computer control. The report contains complete specifications, including a description of the functions of the circuits in the decoder. Author (GRA)

N72-23169# Stanford Research Inst., Menlo Park, Calif.

CELLULAR LOGIC-IN-MEMORY ARRAYS, PART 2 Final Report

William H. Kautz and Marshall C. Pease, III Nov. 1971 87 p refs

(Contract N00014-70-C-0404; SRI Proj. 5509)

(AD-736710) Avail: NTIS CSCL 09/2

The work reported here has developed a design for an Associative Processor (AP) and its associated equipment for use in the Advanced Avionics Digital Computer (AADC) for the Naval Air Systems Command. The design, although not fully optimized, has been carried to a point that will permit a realistic evaluation of attainable cost and performance in any given technology. The design has been developed in the specific context of the Kalman filter algorithm for optimal prediction and tracking. Its applicability to a variety of other numerical processes is also demonstrated. Author (GRA)

N72-23170# Boeing Co., Seattle, Wash.
CIRCUS-2: A DIGITAL COMPUTER PROGRAM FOR TRANSIENT ANALYSIS OF ELECTRONIC CIRCUITS. VOLUME 1: USER'S GUIDE Final Report
Benjamin Dembart and Loren D. Milliman Jul. 1971 106 p (Contract DAAG39-67-C-0070)
(AD-736379; HDL-0070-1-Vol-1) Avail: NTIS CSCL 09/2

CIRCUS-2 is a digital computer program that computes the time domain response of an electronic circuit to an arbitrary forcing function. The dc steady-state of the network can be calculated by the program and used as an initial condition for the transient solution, or a set of initial conditions may be input. CIRCUS-2 has models for basic elements and accepts user-defined models for other circuit components. The relationships allowed between elements in a model are quite general so that most types of components can be readily simulated. In the volume, a complete description of input required by the code is given along with a discussion of the options that may be used in modeling and in circuit analysis. Several examples are provided.
Author (GRA)

N72-23288 International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
GROUND DATA PROCESSING CONSIDERATIONS FOR EARTH RESOURCE INFORMATION
Leonard E. Mumbower *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources 4 May 1972 26 p (See N72-23280 14-13)
Copyright. Avail: Issuing Activity

N72-23289 Radio Corp. of America, Hightstown, N.J. Ground Data Handling Systems.
USER DATA PROCESSING REQUIREMENTS
Herbert Gurk *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 15 p (See N72-23280 14-13)
Copyright. Avail: Issuing Activity

N72-23391*# Scripta Technica, Inc., Washington, D.C.
INPUT OF INFORMATION RECORDED ON MAGNETIC TAPE IN THE BESM-3M COMPUTER
E. L. Afraymovich, G. M. Kudelin, and G. M. Pelenitsyn *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 69-73 (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 09B

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N72-23171* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SCR LAMP DRIVER Patent
Rodger A. Cliff, inventor (to NASA) Issued 16 Nov. 1971 6 p Filed 26 Nov. 1968
(NASA-Case-GSC-10221-1; US-Patent-3,621,294; US-Patent-Appl-SN-779025; US-Patent-Class-307-252N; US-Patent-Class-307-252R; US-Patent-Class-307-259; US-Patent-Class-307-305) Avail: US Patent Office CSCL 09E

A voltage amplitude-responsive trigger circuit includes a silicon-controlled rectifier having its gate electrode biased through a first diode by a dc source. The dc source applies current through a second diode, connected in opposed relationship to the first diode, to a variable amplitude signal source. To change the input voltage at which the SCR triggers, a plurality of diodes may be connected between the dc source and the gate electrode, or a dc voltage may be connected in series with the SCR cathode. Official Gazette of the U.S. Patent Office

N72-23172* National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
METHOD AND APPARATUS FOR MAPPING THE SENSITIVITY OF THE FACE OF A PHOTODETECTOR SPECIFICALLY: A PMT Patent
Otto Youngbluth, Jr., inventor (to NASA) Issued 14 Mar. 1972 8 p Filed 11 Mar. 1970 Supersedes N70-36057 (08 - 19, p 3518)
(NASA-Case-LAR-10320-1; US-Patent-3,649,907; US-Patent-Appl-SN-18427; US-Patent-Class-324-20R) Avail: US Patent Office CSCL 09A

Apparatus and technique for obtaining color-coded area sensitivity maps of photomultiplier tubes are reported. First and second oscilloscopes are driven in synchronism to produce rasters on their faces. The raster of the first oscilloscope is optically imaged on the face of the photomultiplier tube being checked. The output of the photomultiplier is applied to a detector which produces an output if and only if the output of the photomultiplier is between two voltages set into the detector. The output of the detector intensity modulates the second oscilloscope and a color camera takes a picture of the face of the second oscilloscope through a color filter. Different voltages are set into the detector and the camera takes another picture through a different color filter. This procedure is continued which results in a color-coded area sensitivity map of the photomultiplier tube.
Official Gazette of the U.S. Patent Office

N72-23173* National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
LOGARITHMIC FUNCTION GENERATOR UTILIZING AN EXPONENTIALLY VARYING SIGNAL IN AN INVERSE MANNER Patent
Paul R. Caron, inventor (to NASA) Issued 7 Mar. 1972 8 p Filed 28 May 1970 Supersedes N70-36018 (08 - 19, p 3517)
(NASA-Case-ERC-10267; US-Patent-3,648,043; US-Patent-Appl-SN-41348; US-Patent-Class-235-197; US-Patent-Class-307-229; US-Patent-Class-328-145) Avail: US Patent Office CSCL 09E

A technique is described which utilizes an exponentially varying electrical signal in an inverse manner to derive the logarithm of an input signal. In a preferred embodiment of apparatus utilizing the technique, a voltage commensurate with an input signal is compared with an exponentially decaying voltage to provide an output proportional to the time required for the exponential voltage to fall from a preset reference level to the level of the voltage commensurate with the input. This output is employed to control a pulse generator and the output of the pulse generator is averaged to provide a dc voltage which is the logarithm of the input signal.
Official Gazette of the U.S. Patent Office

N72-23174*# General Electric Co., Erie, Pa. Aircraft Equipment Div.
ALTERNATOR INSULATION EVALUATION TESTS
W. B. Penn, R. F. Schaefer, and R. L. Balke Apr. 1972 101 p refs
(Contract NAS3-15691)
(NASA-CR-120901) Avail: NTIS HC $7.25 CSCL 09E

Tests were conducted to predict the remaining electrical insulation life of a 60 KW homopolar inductor alternator following completion of NASA turbo-alternator endurance tests for SNAP-8 space electrical power systems application. The insulation quality was established for two alternators following completion of these tests. A step-temperature aging test procedure was developed for insulation life prediction and applied to one of the two alternators. Armature winding insulation life of over 80,000 hours for an average winding temperature of 248 degrees C was predicted using the developed procedure. Author

N72-23175*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ARC DRIVER OPERATION FOR EITHER EFFICIENT ENERGY TRANSFER OR HIGH-CURRENT GENERATOR
Robert E. Dannenberg and Anthony F. Silva May 1972 34 p refs
(NASA-TM-X-62162) Avail: NTIS HC $3.75 CSCL 09C

An investigation is made to establish predictable electric arcs along triggered paths for research purposes, the intended application being the heating of the driver gas of a 1 MJ electricically driven shock tube. Trigger conductors consisting of wires, open tubes, and tubes pressurized with different gases were investigated either on the axis of the arc chamber or spiraled along the chamber walls. Design criteria are presented for successful arc initiation with reproducible voltage-current characteristics. Results are compared with other facilities and several application areas are discussed. Author

N72-23176# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
EDDY CURRENT MEASUREMENTS WITH A COIL ENCIRCLING A TWO CONDUCTOR ROD
F. D. Mundt 7 Jan. 1972 15 p refs Presented at Spring Conf. of the Am. Soc. for Nondestructive Testing, Los Angeles, Calif., 13 Mar. 1972
(Contract W-7405-eng-26)
(Y-DL-213; Conf-720301-1) Avail: NTIS

Experimental measurements using a coil encircling a coaxial two-conductor rod are described for evaluating the validity of the integral form of the solution to this electromagnetic induction problem. A computer program is used to solve the problem with the experimental parameters to obtain theoretical normalized impedance values. Experimental values of normalized impedance are obtained using a precision impedance bridge, and a comparison is made between the experimental and theoretical values. An estimate of the experimental accuracy is made in order to evaluate the accuracy of the theory. The integral method of predicting eddy current response is very effective and quite accurate. Author

N72-23177# Sandia Labs., Albuquerque, N.Mex. Microcircuit Technology Div.
TRAPATT OSCILLATOR SOURCES: DESIGN PRINCIPLES AND EXPERIMENTAL CIRCUITS
William E. Wilson Jan. 1972 42 p refs Sponsored by AEC
(SC-DR-710785) Avail: NTIS

The physical mechanisms necessary to initiate trapped plasma instabilities in a reverse biased pn junction diode are described. External circuit requirements needed to support large signal microwave oscillations in fundamental frequency, harmonic frequency, and multiple diode sources are then given. Following this theoretical description, circuit design details, fabricational techniques, and experimental characterization of several microstripline oscillators is reported. Peak power of greater than one kilowatt at one gigahertz with 30 percent efficiency has been achieved for one oscillator employing four diodes operated in series. Author

N72-23178# Hittman Associates, Inc., Columbia, Md.
Ni/ZrOZ HIGH TEMPERATURE THERMAL SWITCH REPORT Interim Report, Nov. 1970 - Jan. 1971
Mar. 1971 21 p refs
(Contract AT(29-2)-2797)
(HIT-488) Avail: NTIS

The high temperature metal thermal switch program was redirected back to the design, development, and testing of thermal switch materials for radioisotope thermoelectric generator heat sources operating above 2000 F. The conversion system of interest for this operating temperature is the Isotope-Brayton cycle. The major goal of this preliminary three month effort was to fabricate thermal switch composite materials and initiate property determination testing. Process development studies on impregnation of the porous zirconia rigidized felt with nickel were conducted and the electroless nickel deposition was selected for the fabrication and testing of nickel/zirconia composites. Author (NSA)

N72-23179# Army Electronics Command, Fort Monmouth, N.J.
NOISE REDUCTION IN BROAD BAND RF POWER AMPLIFIERS USING PHASE LOCK TECHNIQUES
D. Bowman Jan. 1972 36 p refs
(DA Proj. 1S6-662705-A-056)
(AD-736864; ECOM-3522) Avail: NTIS CSCL 09/5

The purpose of the report is to show a technique for reducing the noise output of RF broad band power amplifiers. The report will describe the design, construction, and comparative testing of two types of transmitting systems: (1) a standard crystal oscillator and high gain power amplifier; and (2) a high power voltage control led oscillator and low gain power amplifier phase lock system. Noise outputs over the frequency range of 30 to 75 MHz will be compared on a theoretical as well as empirical basis. These results will serve to show the present state-of-the-art in RF power amplifier low noise design. Author (GRA)

N72-23180# Raytheon Co., Waltham, Mass.
LINEAR HIGH POWER C-BAND AMPLIFIER Final Report
Wesley W. Teich Dec. 1971 52 p refs
(Contract F30602-67-C-0206)
(AD-736762; PT-2382; RADC-TR-71-283) Avail: NTIS CSCL 09/5

The primary effort of the program was directed toward the development of a 10 kW cw crossed-field amplifer (CFA) to cover the 4.4-5.0 GHz communications band. Detailed specifications for the device are presented. The anticipated application, a power booster stage for existing transportable tropo-scatter communications equipment, dictates the requirements for a minimum of 10bD gain (less than 1 kW drive power), high efficiency to permit the design of an amplifier requiring less than 20 kW of prime power total, and mechanical and cooling properties which are compatible with transportable equipment. Author (GRA)

N72-23181# Army Electronics Command, Fort Monmouth, N.J.
A BULK SEMICONDUCTOR MILLIMETER WAVE PHASE SHIFTER
M. M. Chrepta Nov. 1971 19 p refs
(DA Proj. 1T0-61101-A-91-A)
(AD-737183; ECOM-3513) Avail: NTIS CSCL 09/5

In this report an analysis of the parameters of a dielectric semiconductor waveguide is given, and the analysis and design of a bulk semiconductor phase shifter is presented. Calculations and experiments have been carried out at frequencies in the Ku-Band. These concepts are applicable not only at this wavelength but even more so in the millimeter and submillimeter regions of the spectrum. The mechanism of the phase shift device is discussed and analyzed with a technique similar to that used in integrated optics. Author (GRA)

N72-23182# Army Electronics Command, Fort Monmouth, N.J.
DESIGN OF A HIGH STABILITY VOLTAGE CONTROLLED CRYSTAL OSCILLATOR
Stanley S. Schodowski Feb. 1972 37 p refs
(DA Proj. 1X6-28012-D-628)
(AD-737185; ECOM-3532) Avail: NTIS CSCL 09/5

Quartz crystal oscillator circuit characteristics are reviewed in respect to achieving a plus or minus 5 ppm overall center frequency tolerance for a 20-22 MHz VCXO under a wide range of operating conditions including channel selection by crystal unit replacement and the inadmissibility of temperature control. A crystal oscillator circuit is described which is capable of a frequency-temperature stability better than plus or minus 4 ppm over a 0 to 60C range while maintaining essential frequency deviation and linearity performance. Author (GRA)

N72-23183# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TECHNOLOGY OF LARGE IMPULSE CURRENTS AND MAGNETIC FIELDS
V. S. Komelkov 4 Dec. 1971 479 p refs Transl. into ENGLISH of the book "Tekhnika Bolshikh Impulsnykh Tokov i Magnitnykh Poley" Moscow, Atomizdat, 1970 p 1-472
(FTD Proj. 7JJ)
(AD-736910; FTD-MT-24-992-71) Avail: NTIS CSCL 14/2

The book furnishes diagrams, calculation methods, characteristics, and designs of power capacitor batteries and their basic elements: capacitors, various types of spark gaps (vacuum, high pressure, solid dielectric), insulation of junction circuits (bushbars, cables), and pulse transformers. Methods of calculating magnetic fields, as well as inductance in solenoids and conductors, are given. The design and behavior of metals in superstrong magnetic fields are examined. Author (GRA)

N72-23184# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMMUNICATION CABLES
I. I. Grodnev 29 Nov. 1971 320 p refs Transl. into ENGLISH of the book "Kabeli Svyazi" USSR, 1965 p 1-279
(AF Proj. 6020; AF Proj. 6010)
(AD-736888; FTD-HC-23-272-71) Avail: NTIS CSCL 09/1

The book discusses the theory of communication cables, the principles of their construction and electric design, and in addition it gives the construction and electric characteristics of modern balanced and coaxial cables. The problem of mutual induction in communication cables, and methods of protection against induction effects are also discussed. Separate chapters are devoted to radio-frequency cables and waveguides. The appendix contains examples of computing electric parameters of cables. Author (GRA)

N72-23185# Owens-Illinois, Inc., Toledo, Ohio.
THREE COLOR PLASMA PANEL DISPLAY DEVICE Quarterly Report, 1 Jul. - 30 Sep. 1971
H. J. Hoehn, R. A. Martel, W. D. Petty, and F. H. Brown Dec. 1971 32 p refs
(Contract DAAB07-70-C-0243; ARPA Order 1582)
(AD-737346; ECOM-0243-5; QR-5) Avail: NTIS CSCL 09/5

Three-color DIGIVUE display/memory panels have been produced by the incorporation of selected photoluminescent phosphors into Xe-filled devices. Over forty phosphor panels with 128 X 128 electrode lines were evaluated. Seven of these had 60 electrode lines per linear inch and the others were 33 lines per inch. Phosphor deposition techniques have been extended to provide uniform coatings over larger areas. A "multiple photomaster" system has been devised to compensate for variations in panel substrate movement during normal processing. Artwork for three-color 512 X 512 line panels has been procured and the fabrication of electrode plates and multiple photomaster has begun. An electronic drive system capable of addressing a 128 X 128 line area was completed and checked out. The unit has sustain waveform controls suitable for operating panels in multiple states of intensity. Author (GRA)

N72-23186# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
THE PROXIMITY EFFECT IN SYSTEMS OF PARALLEL CONDUCTORS AND ELECTRICALLY SMALL MULTITURN LOOP ANTENNAS
Glenn Smith Dec. 1971 116 p refs
(Contract N00014-67-A-0298-0005)
(AD-736984; TR-624) Avail: NTIS CSCL 09/5

In the report losses in systems of parallel sound conductors are studied. Both the normal skin effect loss and the additional loss due to the close proximity of adjacent conductors are considered. The results obtained for the parallel conductors are used to evaluate the radiation efficiency of electrically small multiturn loop antennas. Author (GRA)

N72-23187# Catholic Univ. of America, Washington, D.C. Inst. of Ocean Science and Engineering.
A PASSIVE ARRAY-PROCESSOR FOR TRACKING AND SIGNAL EXTRACTION
Carol A. Roberts Feb. 1972 116 p refs
(Contract N00014-69-A-0432)
(AD-737322; Rept-72-3) Avail: NTIS CSCL 09/2

The passive array-processor considered here employs techniques that were developed for monopulse radars to perform the tasks of target detection and tracking. Extracting the target signal from a noisy background is accomplished using an adaptive multichannel filter. A complete monopulse processor that is easy to implement digitally is described. The variance of the bearing estimator for this process is derived and this is compared with the variance obtained from computer simulations. The process offers a very powerful bearing determination technique to be used with passive linear arrays. Author (GRA)

N72-23188# Valpey Fisher Corp., Holliston, Mass.
SHOCK RESISTANT QUARTZ CRYSTAL UNITS Semiannual report, 1 Jun. - 30 Nov. 1971
William T. Liggett Jan. 1972 58 p
(Contract DAAB07-72-C-0245)
(AD-737307; ECOM-0245-1) Avail: NTIS CSCL 09/1

The report covers testing of 10 crystal units per frequency purchased from three crystal manufacturers on QPL list plus 10 of each frequency manufactured by Valpey-Fisher. The crystal units were manufactured to specifications for Type CR-64/U at 2.90000, 4.60000, 7.40000, 12.0000 and 20.0000 MHz.
Author (GRA)

N72-23189# Rhode Island Univ., Kingston. Dept. of Electrical Engineering.
ABSOLUTE CALIBRATION OF ANTENNAS AT EXTREMELY LOW FREQUENCIES Final Technical Report, 1 Nov. 1970 - 1 Nov. 1971
Manfred Clayton, Charles Polk, Hellmuth Etzold, and William Cooper 1 Jan. 1972 50 p refs
(Contract N00014-68-A-0215-0005; NR Proj. 371-490)
(AD-737286; URI-EE-4041/2) Avail: NTIS CSCL 09/5

The object of the work was the calibration of ELF (extremely low frequency) electric field sensors. In particular it was desired to compare the calculated with the measured effective height or, equivalently, to compare the measured terminal voltage at a receiving antenna with the predicted value when the incident field is precisely known. This incident field was generated by an electrically very short, thin linear radiator. Formulas are given for the field in the immediate vicinity of such a radiator above a perfectly conducting ground. Also given is an expression for the integral of this field along a vertical path starting at ground level. Author (GRA)

N72-23190# Sylvania Electric Products, Inc., Waltham, Mass. Microelectronics Operation.
RELIABILITY OF CERAMIC MULTILAYER BOARDS Final Technical Report, May 1970 - Jun. 1971
John R. Moore, Courtney Furnival, and John Burt Griffiss AFB, N. Y. RADC Dec. 1971 116 p refs
(Contract F30602-70-C-0212)
(AD-737373; RADC-TR-71-299) Avail: NTIS CSCL 09/5

The objective of the program was threefold: one, to bring up-to-date the current literature and information presently available in this very new packaging technology of ceramic multilayers; two, to construct a simple circuit of sufficient interwiring density that would require at least four wiring levels and a representative materials technology; and three, a test series that would create sufficient environmental stress to be able to assess the quality of the systems involved. Author (GRA)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N72-23191*# Connecticut Univ., Storrs. Dept. of Electrical Engineering.
MINIMAX CONTROL OF A SYSTEM WITH PROCESS UNCERTAINTY IN SUBSTATE SPACE
Sibnath Basuthakur and Charles H. Knapp [1970] 26 p refs
(Grant NGL-07-002-002)
(NASA-CR-126396) Avail: NTIS HC $3.50 CSCL 09C

The control of a single input-single output plant with parameter uncertainty was approached using a minimax technique. A linear time invariant controller results which requires only partial state feedback and is optimal in the sense that it minimizes a quadratic criterion involving tracking error, control, and parameter uncertainty. Bounded input-bounded output stability is guaranteed provided the transfer function has only left half plane zeros. If uncertainties are bounded, it is always possible to stabilize the system when sufficient control amplitude is available. The number of states required to generate the control is equal to the system order less the number of zeros. Author

N72-23192*# Connecticut Univ., Storrs. Dept. of Electrical Engineering.
EFFECTS OF INCOMPLETE ADAPTION AND DISTURBANCE IN ADAPTIVE CONTROL
D. P. Lindorff Feb. 1972 18 p refs
(Grant NGL-07-002-002)
(NASA-CR-126379; TR-72-1) Avail: NTIS HC $3.00 CSCL 12A

This investigation focused attention on the fact that the synthesis of adaptive control systems has often been discussed in the framework of idealizations which may represent over simplifications. A condition for boundedness of the tracking error has been derived for the case in which incomplete adaption and disturbance are present. When using Parks' design it is shown that instability of the adaptive gains can result due to the presence of disturbance. The theory has been applied to a nontrivial example in order to illustrate the concepts involved. Author

N72-23193*# New Hampshire Univ., Durham.
APPLICATIONS OF CONTROL THEORY Final Report, 1 Jul. 1969 - 30 Sep. 1971
Charles K. Taft, J. L. Pokoski, J. B. Murdoch, D. E. Limbert, and R. W. Alperi Mar. 1972 147 p refs
(Grant NGR-30-002-056)
(NASA-CR-126402) Avail: NTIS HC $9.50 CSCL 12B

Applications of control theory are considered in the areas of decoupling and wake steering control of submersibles, a method of electrohydraulic conversion with no moving parts, and socio-economic system modelling. K.P.D.

N72-23194*# Arizona Univ., Tucson. Dept. of Electrical Engineering.
USE OF A THREE-LAYER DISTRIBUTED RC NETWORK TO PRODUCE TWO PAIRS OF COMPLEX CONJUGATE ZEROS
L. P. Huelsman Jan. 1972 14 p refs
(Grant NGL-03-002-136)
(NASA-CR-126401) Avail: NTIS HC $3.00 CSCL 12A

The properties of a three layer distributed RC network consisting of two layers of resistive material separated by a dielectric are described. When the three layer network is used as a three terminal element by connecting conducting terminal strips across the ends of one of the resistive layers and the center of the other resistive layer, the network may be used to produce pairs of complex conjugate transmission zeros. The location of these zeros are determined by the parameters of the network. Design charts for determining the zero positions are included as part of the report. Author

N72-23195*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PILOT/VEHICLE CONTROL OPTIMIZATION USING AVERAGED OPERATIONAL MODE AND SUBSYSTEM RELATIVE PERFORMANCE INDEX SENSITIVITIES
Gary G. Leininger (Toledo Univ.), Bruce Lehtinen, and John P. Riehl 1972 24 p refs Presented at 8th Ann. NASA - Univ. Conf. on Manual Control, Ann Arbor, Mich., 17-19 May 1972
(NASA-TM-X-68041; E-6879) Avail: NTIS HC $3.25 CSCL 09C

A method is presented for designing optimal feedback controllers for systems having subsystem sensitivity constraints. Such constraints reflect the presence of subsystem performance indices which are in conflict with the performance index of the overall system. The key to the approach is the use of relative performance index sensitivity (a measure of the deviation of a performance index from its optimum value). The weighted sum of subsystem and/or operational mode relative performance index sensitivies is defined as an overall performance index. A method is developed to handle linear systems with quadratic performance indices and either full or partial state feedback. The usefulness of this method is demonstrated by applying it to the design of a stability augmentation system (SAS) for a VTOL aircraft. A desirable VTOL SAS design is one that produces good VTOL transient response both with and without active pilot control. The system designed using this method is shown to effect a satisfactory compromise solution to this problem. Author

N72-23196*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN OF TOROIDAL TRANSFORMERS FOR MAXIMUM EFFICIENCY
James A. Dayton, Jr. Washington Apr. 1972 21 p refs
(NASA-TM-X-2539; E-6784) Avail: NTIS HC $3.00 CSCL 09A

The design of the most efficient toroidal transformer that can be built given the frequency, volt-ampere rating, magnetic flux density, window fill factor, and materials is described. With the above all held constant and only the dimensions of the magnetic core varied, the most efficient design occurs when the copper losses equal 60 percent of the iron losses. When this criterion is followed, efficiency is only slightly dependent on design frequency and fill factor. The ratios of inside diameter to outside diameter and height to build of the magnetic core that result in transformers of maximum efficiency are computed. Author

N72-23197*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SINGULAR PERTURBATIONS IN THE STATE REGULATOR PROBLEM
Mark D. Ardema Apr. 1972 57 p refs
(NASA-TM-X-62146) Avail: NTIS HC $5.00 CSCL 12A

Most of the results of singular perturbation theory have been concerned with initial value problems whereas optimal control problems are of two-point boundary value type. The portions of this theory applicable to the open loop state regulator problem are reviewed. For obtaining approximate solutions to the state regulator problem the method of matched asymptotic expansions is employed. This method has been developed in connection with certain fluid mechanics problems and is applicable to nonlinear as well as linear problems. It has been found in the past to be advantageous not to formulate this method generally but to apply it to each individual problem and this approach is adopted here. A general recipe for the method is given and its application is illustrated by using the method to obtain an approximate solution to a simple, specific state regulator problem. Author

N72-23198*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va. School of Engineering and Applied Science.
OPTIMAL FEEDBACK CONTROL FOR NONLINEAR CONTROL MOMENT GYRO SYSTEMS Ph.D. Thesis - Virginia Univ.
Robert G. Kyle Jun. 1969 119 p refs
(NASA-TM-X-67790) Avail: NTIS HC $8.00 CSCL 09C

A study was made, leading to development and analysis of a technique allowing the control moment gyro (CMG) momentum vectors to avoid adverse orientations and thus to provide optimal control for the Apollo Telescope Mount. The technique was formulated in terms of a feedback scheme using a check factor, K, formed as the product of the dot products of the three CMG momentum unit vectors. The parameter K approaches unity for all adverse orientations and was used to initiate a single correction maneuver to rotate the CMG momenta away from a pending adverse orientation and to reduce K to an acceptable value. A digital computer program for ATM simulations was modified to incorporate this correction maneuver and performance was evaluated in simulated cases. Antiparallelism was used as the primary example for the evaluation of the feedback optimization technique. Author

N72-23199# Sandia Labs., Albuquerque, N.Mex.
CONTOUR MAPPING OF THE CURRENT DISTRIBUTION FROM THE PULSED REBA ELECTRON BEAM MACHINE VERSUS TIME WITH AN ARRAY OF FARADAY CUPS
John G. Kelly and Robert L. Schuch Jun. 1971 124 p refs Sponsored by AEC
(SC-RR-710655) Avail: NTIS

An array of 13 small Faraday cups was used to measure the time development of the spatial distribution of a 45 kA, 3.5 MeV, 100 nsec pulsed electron beam in a 10-inch (25.4 cm) diameter drift tube at air pressures of 22.5 and 3.9 Torr and 520, 320, 160, and 90 microns. The contour maps constructed from these data display the formation and the decay of the pinch structure. Discussions are given of the Faraday cup array design, of the experiment on the REBA accelerator, and of the data reduction techniques. Author (NSA)

N72-23200# Addis Translations International, Woodside, Calif.
INSULATION RESISTANCE OF PRINTED CIRCUIT BOARDS. BEHAVIOR OF CERTAIN TYPES AND MAKES UNDER DIFFERENT CLIMATIC CONDITIONS
S. T. Olesen Nov. 1971 32 p Transl. into ENGLISH from "Isolationsmodstand i Printplader. En Undersogels af en Raekke Typer og Fabrikater under Forskellige Klimatiske Forhold", Danish Res. Centre for Appl. Electron., report ECR-14, Jul. 1970 38 p Sponsored by AEC Prepared for Sandia Labs., Albuquerque, N.Mex.
(SCL-T-710296; ECR-14) Avail: NTIS

The insulation measurements were performed on boards just received from the manufacturer, as well as on boards exposed to humidity or to elevated temperatures. A total of 33 types from five different material categories (phenol/paper, epoxy/paper, epoxy/glass, polyester/glass, and Teflon/glass) were obtained from a number of industrial consumers and suppliers. The purpose of the project was to investigate the frequency with which batches with insufficiently baked material, and consequently having a poor insulation resistance, were encountered. No such batches were found, and it is likely that they do not occur as often as had previously been assumed. Author

N72-23201# Illinois Univ., Urbana. Coordinated Science Lab.
DESIGN OF SELF-CHECKING DIGITAL NETWORKS USING CODING TECHNIQUES
Douglas Arthur Anderson Sep. 1971 138 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-15459)
(AD-735677; UILU-ENG-71-2230; R-527) Avail: NTIS CSCL 09/2

The redundancy necessary in self-checking circuits is investigated from a coding theory viewpoint. The determination of code capabilities is examined and a polarized distance technique is introduced and shown to be useful for determining the error-detecting/correcting capabilities of binary block codes in cases where bit errors are not random, that is, not symmetric and independent. The design of combinational circuits with encoded inputs and encoded outputs is considered. For such circuits the concepts of self-testing and fault-secure are introduced; circuits that are both self-testing and fault-secure are defined to be totally self-checking. Author (GRA)

N72-23202# California Univ., Berkeley. Operations Research Center.
A PRIMAL APPROACH TO NETWORK FLOW PROBLEMS WITH CONVEX COSTS
Andres F. Weintraub Nov. 1971 96 p refs
(Contract NSF-GP-30961)
(PB-205653; ORC-71-30) Avail: NTIS HC $3.00 CSCL 12B

The problem of determining a flow of minimum cost in a network with convex costs on the arcs is analyzed. The approach used is that of finding, for any given feasible flow, circuit flows of negative incremental costs. In the main theoretical result, it is proved that if at each stage, given a feasible nonoptimal flow F, the circuit flow with most negative incremental cost is added to F, linear convergence to the optimal solution will be obtained. This theoretical analysis is extended to a general program with linear constraints and convex separable costs. Author (GRA)

N72-23203# GTE Labs., Inc., Waltham, Mass.
MULTI-CHIP INTEGRATED CIRCUIT PACKAGE Final Technical Report, 1 Jun. 1968 - 31 Aug. 1971
Nino P. Cerniglia, Kirk Anderson, Ben VanBjren, Joe Dimauro, and Jack Ramsey Wright-Patterson AFB, Ohio AFML Aug. 1971 270 p refs
(Contract F33615-68-C-1632; AF Proj. 506-8A)
(AD-736790; AFML-TR-71-167) Avail: NTIS CSCL 09/5

The objective of the contract is to reduce to practice a compatible multi-chip interconnection system for unpackaged integrated circuits, eliminating insofar as possible wire bonds and interconnection interfaces, and achieving high yield, low cost, and high reliability. A pilot production line was set up in this project to product sufficient units for test and cost evaluation. This project is based on the use of beam-leaded IC's and an air-insulated beam-lead crossover interconnection method. This is the final report on this multi-chip contract. The conclusions and recommendation sections support the basic advantages of the beam-lead system. Author (GRA)

N72-23204# Washington Univ., St. Louis, Mo. School of Engineering and Applied Science.
FURTHER RESULTS ON THE SINGULAR CONTROL FOR DISCRETE LINEAR SYSTEMS
John Zaborszky and Tzyh-Jong Tarn 18 Oct. 1971 13 p refs
(Contract F44620-69-C-0116; Grant NSF GK-4394; NSF GK-5570; AF Proj. 7921)
(AD-736801; CSSE-725; AFOSR-72-0311TR) Avail: NTIS CSCL 12/1

By the application of dynamic programming, singular control for linear time invariant discrete systems with fixed endpoint may be solved. Unlike the continuous singular control problems, the authors classify the singular control of linear discrete systems as a singular problem and as strongly singular problems. Author (GRA)

N72-23205# Air Force Academy, Colo. Frank J. Seiler Research Lab.
COMPUTATIONAL REQUIREMENTS ASSOCIATED WITH THE CONTROL OF UNSTABLE SYSTEMS Interim Scientific Report
John F. Schaefer Feb. 1972 15 p refs Presented at the 4th Winter Inst. on Advanced Control, Fla. Univ., Feb. 1967
(AD-737356; SRL-TR-72-0002) Avail: NTIS CSCL 12/1

The report illustrates the almost complete reliance a control engineer must have on computational machine aid when synthesizing controllers for extremely complex dynamical systems. It outlines both the steps which were taken in attacking one such problem and the results, and in the process points out those operations and manipulations which without modern computational equipment could not have been possible. The specific illustrative example used, an unstable dynamic balanced flexible beam assembly, is not critical to the points made; it is not difficult to visualize for other systems the consequences of insufficient accuracy and reliability in the computing machinery.
Author (GRA)

N72-23206# Brown Univ., Providence, R.I. Div. of Applied Mathematics.
A DESIGN PROCEDURE FOR MULTIVARIABLE CONTROL SYSTEM
A. E. Pearson and W. N. Anakwa Feb. 1972 35 p refs
(Grants AF-AFOSR-2078-71; NSF GK-31073X; AF Proj. 9769)
(AD-736836; AFOSR-72-0361TR) Avail: NTIS CSCL 12/1

A design procedure is presented which focuses upon a dynamic compensator of prespecified structural form. The order and feedback matrices of the compensator are first chosen to achieve stability through pole assignment via plant output feedback. The compensator feedforward matrices are then selected to satisfy various steady-state and static or dynamic decoupling constraints.
Author (GRA)

N72-23207# California Univ., Santa Barbara. Dept. of Electrical Engineering.
LINEAR STOCHASTIC OPTIMAL CONTROL UNDER INFORMATION RATE CONSTRAINTS
Russell J. Lefever (Tech. Serv. Corp., Santa Monica, Calif.) and Edwin B. Stear Feb. 1972 29 p refs
(Grant AF-AFOSR-2166-72; AF Proj. 9749)
(AD-737139; AFOSR-72-0376TR) Avail: NTIS CSCL 12/1

The discrete-time, linear, stochastic optimal control problem is considered under information rate constraints on the feedback loop. The feedback loop, including sensor, is modeled as a communication channel which provides a specified amount of information (in the Shannon sense) about the state of the linear plant at each discrete-time instant given the current and past observations and past controls. No further specific structure for the sensor is assumed. The expected value of a positive definite quadratic loss function is used as the performance criterion to be minimized. This leads to a double minimization problem in which the performance criterion is minimized over the set of admissible controls and the set of conditional probability densities for the state given the observations and controls which achieve the specified information. A set of recursion relationships for the solution of this problem is derived.
Author (GRA)

N72-23208# California Univ., Santa Barbara. Dept. of Electrical Engineering.
STOCHASTIC OPTIMAL CONTROL WITH A CONSTRAINED FEEDBACK INFORMATION RATE
Edwin B. Stear and Russell J. Levre Feb. 1972 11 p refs Prepared in cooperation with Technology Service Corp., Santa Monica, Calif.
(Grant AF-AFOSR-2166-72; AF Proj. 9749)
(AD-737365; AFOSR-72-0375TR) Avail: NTIS CSCL 12/1

In the paper the stochastic optimal problem is considered for the case where the exact relationship between the observables and the state of the plant is unknown. Instead of assuming a known sensor structure, it is assumed that the unknown sensor is modeled as a communication channel which transmits information about the state to the controller at a fixed given information rate (in the Shannon sense). This leads to a double minimization problem over the set of admissible controls and the set of admissible conditional probability density functions describing the sensor.
Author (GRA)

N72-23209# Illinois Univ., Urbana. Coordinated Science Lab.
DATA MANIPULATION AND SENSING: PLASMA DISPLAY Final Report, 20 Feb. 1970 - 15 Apr. 1971
Roger L. Johnson, William Coates, and Larry F. Weber Griffiss AFB, N. Y. RADC Dec. 1971 130 p refs
(Contract F30602-70-C-0145)
(AD-737371; RADC-TR-71-274) Avail: NTIS CSCL 09/5

A program to develop and investigate techniques for electronically sensing the state of plasma display elements and techniques for manually and electronically altering information on a plasma display panel has been completed. The work was divided into two major areas: (1) data sensing and (2) data manipulation.
Author (GRA)

N72-23210# Purdue Research Foundation, Lafayette, Ind.
CONDUCTION MECHANISMS IN THICK FILM MICRO-CIRCUITS Semiannual Technical Report, 1 Jul. - 31 Dec. 1971
R. W. Vest 1 Feb. 1972 50 p refs
(Grant DAHC15-70-G7; ARPA Order 1642)
(AD-737382) Avail: NTIS CSCL 09/1

The specific objectives of the program are: (1) Determine the dominant sintering mechanisms responsible for microstructure development, and establish the relative importance of the various properties of the ingredient materials. (2) Determine the dominant mechanisms limiting electrical charge transport, and establish the relative importance of the various properties of the ingredient materials. (3) Develop phenomological models to inter-relate the various material properties with system performance. A proposed model to satisfy objective 1 is presented in this report, and an experimental program is being developed to test the various aspects of the model.
Author (GRA)

N72-23211# Admiralty Surface Weapons Establishment, Portsmouth (England).
DC CIRCUIT ANALYSIS BY COMPUTER
N. A. Walter and P. B. A. Border Oct. 1971 20 p refs
(AD-737089; ASWE-TR-71-32; DRIC-BR-27902) Avail: NTIS CSCL 09/5

The Technical Report describes the importance of correct loading of electronic components in circuits to ensure the reliability of circuit operation initially and over a long period of time. The full mathematical analysis of a circuit to establish these conditions allowing for the various changes in parameter can be a time consuming and difficult process. However by using the computer and correctly chosen programs it is possible to perform a complete d.c. analysis very simply, including junction temperature of any transistors. In order to demonstrate this, a number of examples are taken using several different programs readily available to the user.
Author (GRA)

N72-23212# RAND Corp., Santa Monica, Calif.
SOVIET CYBERNETICS REVIEW, VOLUME 1, NO. 5
Wade B. Holland Sep. 1971 71 p
(Contract F44620-67-C-0045)
(AD-734574; R-700/5-PR) Avail: NTIS MF only. HC avail. from Rand Corp., 1700 Main Street, Santa Monica, Calif. 90406. Attn: Mr. Thomas M. Cockrell: $3.00 CSCL 09/2

Soviet plans for a large-scale program of automation of industry and of national economic management are beginning to appear with the promulgation of the directives of the 24th CPSU Congress. All national industrial, transport, construction, and agricultural ministries are to have computerized management control systems in operation by 1975, the end of the current five-year plan. Computerized management goals are described, including the SNCC options to local systems, agriculture's use of the computer network, and Lithuanian management systems for 10 industries in their republic. The RUTA-110 computer and magnetic disc unit are also considered.
Author (GRA)

N72-23213# RAND Corp., Santa Monica, Calif.
SOVIET CYBERNETICS TECHNOLOGY. 12: TIME-SHARING IN THE SOVIET UNION
Oct. 1971 77 p refs
(Contract F44620-67-C-0045)
(AD-737321; R-522-PR) Avail: NTIS CSCL 09/2

The report contains a study of the current state of Soviet computer technology, the major computers suitable for timesharing, and timesharing applications and research.
Author (GRA)

N72-23214# RAND Corp., Santa Monica, Calif.
SOVIET CYBERNETICS REVIEW, VOLUME 1, NO. 6
Wade B. Holland, ed. Nov. 1971 68 p
(Contract F44620-67-C-0045; Proj. RAND)
(AD-737323; R-700/6-PR) Avail: NTIS CSCL 09/2

Noteworthy among many articles on implementing the Party Congress directives to push automation is a Science and Technology editorial warning against a narrow, production-oriented approach--a broad, socio-economic approach is needed. A Pravda editorial recounts barriers to automated production control; a Socialist Industry article specifies them with unusual directness--lack of authority to match responsibility for automation, unrealistic training, little help from some advisory institutes, nondissemination of successful methods. Other articles discuss specific problems. Irkutsk is experimenting with a regionwide control/management system. Centralized territorial servicing of Minsk computers is highly successful in Riga but has not been adopted elsewhere or for other makes. The goal of 12-15,000 Ryad computers, publicized abroad, has yet to see print at home; the internal version is given. Other articles discuss information retrieval; tracking the Salyut orbital station; computer grading of written examinations and prediction of epidemics; establishment of an Administration of Scientific Instrument Construction.
Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N72-23215* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
HIGH TEMPERATURE FURNACE FOR MELTING MATERIALS IN SPACE Patent
John R. Rasquin, inventor (to NASA) Issued 7 Mar. 1972 5 p Filed 12 Feb. 1971
(NASA-Case-MFS-20710; US-Patent-3,647,924; US-Patent-Appl-SN-114848; US-Patent-Class-13-20; US-Patent-Class-13-31) Avail: US Patent Office CSCL 14B

An electrically powered furnace is described for melting high-melting point materials in the vacuum and zero gravity environment of space comprising an alumina crucible and enclosing a cylindrical tantalum sample holder that contains the sample to be melted. The crucible is surrounded by concentric cylindrical enclosures made of polished sheet molybdenum. The sample holder is clamped between a pair of round plates and a pair of alignment bolts are joined to the circular plates and extend along the longitudinal axis of the furnace through the end covers of the crucible and surrounding concentric enclosures.
Official Gazette of the U.S. Patent Office

N72-23216 New Mexico State Univ., University Park.
SLED DESIGN TECHNIQUES Ph.D. Thesis
Larry Campen Mixon 1971 471 p
Avail: Univ. Microfilms Order No. 71-22707

A modeling program was conducted to establish the accuracy with which lumped mass-stiffness computer programs can model a sled. Detail deflection and inertia analyses were performed to establish basic sled models then modal tests were conducted to establish a validity of the models. Differences between the mathematical models predictions and test results were studied in detail. Random analysis techniques were then applied to the sled linear computer models. Three computer programs were used to analyze the response of the multi-degree-of-freedom elastic models to multi-input stationary random dynamic loadings. These design techniques were organized into recommended design procedures for rocket sleds. Experimental design factors for thrust, braking forces, and oscillatory slipper forces were outlined in detail to assist in solving future structural problems, and a theoretical approach was offered for more involved design problems. Dissert. Abstr.

N72-23217*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
A STUDY OF LC-39 CRYOGENIC SYSTEMS. PART 1: A STUDY OF THE VACUUM INSULATED TRANSFER LINES AT KENNEDY SPACE CENTER. PART 2: COOLDOWN PRESSURE SURGES Final Report
Paul R. Ludtke and Roland O. Voth 22 Sep. 1971 255 p refs
(NASA Order CC-80302; NBS Proj. 275.05-2750458)
(NASA-CR-126386; NBS-10705-Pt-1; NBS-10705-Pt-2) Avail: NTIS HC $14.75 CSCL 14B

The vacuum liquid hydrogen and liquid oxygen transfer lines at Kennedy Space Center were studied to evaluate the feasibility of using a condensing gas such as CO2 inside the vacuum spaces to achieve a condensing-vacuum. The study indicates that at ambient temperature, a maximum vacuum hyphen space pressure of 4000 microns is acceptable for the LH2 transfer lines. In addition, the cooldown procedures for the 14-inch cross-country liquid oxygen line was studied using a simplified mathematical model. Preliminary cooldown times are presented for various heat leak rates to the line and for two vent configurations.
F.O.S.

N72-23218*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A 400 KILOWATT ARGON ARC LAMP FOR SOLAR SIMULATION
Arthur J. Decker and John L. Pollack 1972 22 p refs Presented at 6th Space Simulation Conf., New York, 1-4 May 1972; sponsored by Inst. of Environ. Sci., Am. Inst. of Aeron. and Astronaut., and Am. Soc. for Testing and Mater.
(NASA-TM-X-68042; E-6875) Avail: NTIS HC $3.25 CSCL 14B

A 400 kilowatt argon arc lamp for a solar simulator has been designed, operated, and evaluated. The lamp is designed to produce one solar constant on a test area 4.6 by 9.2 meters when used with a collimator. The divergence angle of the beam is about 1 deg. The lamp is designed to operate completely within a vacuum environment. Over 80 kilowatt of directed radiation was monitored and measured for a 25-hour period during a recent test. In another test, an arc was operated at 400 kilowatt for 110 hours without removal or refurbishing of the electrodes. These tests have proven the cleanliness and integrity of the radiation source.
Author

N72-23219# EWR Fairchild International, Munich (West Germany).
NEW SUPPLY TO CERN PROTON SYNCHROTRON MAGNET. 2: DESCRIPTION OF COMPONENTS [LA NOUVELLE ALIMENTATION DE L'AIMANT DU SYNCHROTON A PROTONS DU CERN. FASCICULE 2: DESCRIPTION DES COMPOSANTS]
O. Bayard 28 Sep. 1971 146 p refs In FRENCH
(CERN-71-20) Avail: AEC Depository Libraries

The details of the new power supply to the CERN proton synchrotron are given. The magnet and its excitation cycles, the

rotating group, the conversion stations and the filters, and the apparatus of control, synchronization, and regulation are discussed. Author (NSA)

N72-23220# Southwestern Radiological Health Lab., Las Vegas, Nev.
REPORT OF OFF-SITE SURVEILLANCE FOR PROJECT CABRIOLET
27 Dec. 1971 70 p refs Supported by AEC
(PNE-959) Avail: NTIS

Project Cabriolet which was a 2.5-kt nuclear excavation experiment conducted at the Nevada Test Site on January 26, 1968, as part of the Plowshare program is reported. The results of the off-site radiological surveillance program conducted for this event by the Public Health Service are presented. Aircraft and ground monitoring teams documented the radioactivity discharged to the atmosphere from this event as it traveled northward from the Nevada Test Site into southern Idaho, then north-eastward where it was detected as far as Big Timber, Montana. The highest external gamma exposure rate observed off-site was 65 mR/hr measured at Clark Station, Nevada, during cloud passage by a permanent exposure rate recorder. This is a populated location 61 miles from ground zero on an azimuth of 353 deg. The exposure at Clark Station for cloud passage plus seven days residual activity was 8 mR. The highest exposure from cloud passage in the off-site area as measured by thermoluminescent dosimeters was 12 mR two miles west of Clark Station. Author (NSA)

N72-23221# Rome Univ. (Italy). School for Aerospace Engineering.
PRESENT AND FUTURE DEVELOPMENTS IN GAS DYNAMIC EXPERIMENTATION [PRESENTI E FUTURI SVILUPPI PER LA SPERIMENTAZIONE GASDINAMICA]
Carlo Buongiorno Dec. 1970 19 p refs In ITALIAN /ts ATTI del Centro Ric. Aerospaziali No. 36
Avail: NTIS HC $3.00

Trends in gas dynamics experimentation in connection with the development of supersonic aircraft, space transportation systems, and the problems of planetary entry are reviewed. The main features are the development of wind tunnel facilities at very high Reynolds numbers, and the simulation of both stagnation enthalpies of from 500 to 1000 M joule/kg of planetary atmospheres. The development of supersonic combustion ramjets flying at Mach numbers of from 10 to 12 is also considered. Author (ESRO)

N72-23222# Naval Civil Engineering Lab., Port Hueneme, Calif.
AIRFIELD PAVEMENT CONDITION SURVEY, USNAS WHIDBEY ISLAND AND USNOF COUPEVILLE, WASHINGTON
David J. Lambiotte and Leonard J. Woloszynski Nov. 1971 112 p ref
(NCEL Proj. 53-125)
(AD-735860; NCEL-TN-1201) Avail: NTIS CSCL 01/5

The results of condition surveys of the airfield pavements at the U. S. Naval Air Station, Whidbey Island and U. S. Naval Outlying Field, Coupeville are presented. The surveys established statistically-based condition numbers (weighted defect densities) which were direct indicators of the conditions of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts at NAS Whidbey Island included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft, traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts.
Author (GRA)

N72-23223# General Motors Technical Center, Warren, Mich. Materials and Structures Lab.
MEASUREMENTS OF DYNAMIC PROPERTIES OF MATERIALS. VOLUME 3: 6061-T6 ALUMINUM Final Report
Douglas R. Christman, William M. Isbell, Stephen G. Babcock, Allen R. McMillan, and Sidney J. Green Nov. 1971 162 p refs
(Contract DASA01-68-C-0114)
(AD-735966; MSL-70-23-Vol-3; DASA-2501-3-Vol-3) Avail: NTIS CSCL 14/2

Results of an experimental study on the dynamic properties of 6061-T6 aluminum are presented. Areas studied included stress-strain-strain rate and reverse loading behavior, elastic constants, equation of state, compressive and release wave characteristics, and spall fracture. The shock wave equation of state (EOS) calculated from the elastic constants and comparisons made with the shock wave EOS. Compressive wave tests showed a well-defined elastic precursor with a steady-state value of approximately 5 kbar. The yield level from shock wave profile measurements was approximately the same as that determined from uniaxial stress and EOS tests. The impact velocity required for spall fracture was found to increase with decreasing pulse width, and to decrease with increasing temperature. Author (GRA)

N72-23224# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
EVALUATION OF HARVEY ALUMINUM 1 FT BY 12 FT EXTRUDED LIGHT-DUTY LANDING MAT WITH OVERLAP/UNDERLAP END CONNECTORS Final Report
Hugh L. Green and Charles T. McCormick Dec. 1971 70 p refs
(DA Proj. 1G6-64717-DH-01)
(AD-735783; AEWES-Misc-Paper-S-71-29) Avail: NTIS CSCL 01/5

The 1- by 12-ft mat is a one-piece hollow extrusion fabricated from 6063 aluminum alloy artifically aged to the T6 condition. The mat panels are interlocked along the sides by means of a hinge-type connector, the components of which are integral parts of the basic extrusion. End connectors, composed of extruded connectors welded to the basic panel and aluminum inserts using the electron bean (EB) welding method, consist of overlap and underlap sections that are secured by a locking bar after individual panels have been joined together. The investigation consisted of laboratory, traffic, and skid tests to obtain information for use in evaluating Harvey mat for potential use as a light-duty landing mat. Author (GRA)

N72-23225# Naval Civil Engineering Lab., Port Hueneme, Calif.
AIRFIELD PAVEMENT CONDITION SURVEY, USNAF CHINA LAKE, CALIFORNIA
H. Tomita and R. B. Brownie Nov. 1971 88 p ref
(AD-735862; NCEL-53-125; N-1203) Avail: NTIS CSCL 01/5

The results of a condition survey of the airfield pavements at the U. S. Naval Air Facility, China Lake, California are presented. The survey established statistically-based condition numbers (weighted defects densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests. Author (GRA)

N72-23226# Naval Civil Engineering Lab., Port Hueneme, Calif.
AIRFIELD PAVEMENT CONDITION SURVEY, USMCAS KANEOHE, HAWAII
H. Tomita and J. A. Garcia Nov. 1971 73 p refs
(NCEL Proj. 53-125)
(AD-735861; NCEL-TN-1202) Avail: NTIS CSCL 01/5

The results of a condition survey of the airfield pavements at the U. S. Marine Corps Air Station, Kaneohe, Hawaii, are presented. The survey established statistically-based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additonal evaluation efforts

included photographic coverage of defect types, preparation of the construction history of the station, compilation of the data on current aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts. Author (GRA)

N72-23227# Naval Civil Engineering Lab., Port Hueneme, Calif.
AIRFIELD PAVEMENT CONDITION SURVEY, USNAS ALAMEDA, CALIFORNIA
H. Tomita and L. J. Woloszynski Nov. 1971 94 p ref
(NCEL Proj. 53-125)
(AD-735863; NCEL-TN-1204) Avail: NTIS CSCL 01/5

The results of a condition survey of the airfield pavements at the USNAS Alameda, California are presented. The survey established statistically-based condition numbers (weighted defect densities) which were direct indicators of the condition of the individual asphaltic concrete and portland cement concrete pavement facilities. Additional evaluation efforts included photographic coverage of defect types, preparation of the construction history of the station, compilation of data on current aircraft traffic and aircraft types using the station, performance of runway skid resistance tests, and a study of the requirements for future pavement evaluation efforts. Author (GRA)

N72-23228# Illinois Univ., Urbana. Coordinated Science Lab.
[COORDINATED SCIENCE RESEARCH] Progress Reports, 1 Jul. 1970 - 30 Jun. 1971
1 Aug. 1971 431 p refs
(Contract DAAB07-67-C-0199)
(AD-730108) Avail: NTIS CSCL 14/2

Summaries are given of research projects in the following areas: surface studies; applied physics; plasma physics; rarefied gas dynamics; computational gas dynamics; high voltage breakdown; space and atmospheric sciences; semiconductor physics; computer; plasma display; urban development; information science; networks; control systems; digital systems; artificial intelligence; engineering aids for the handicapped; photochromic memory for computer application; information retrieval; highway instrumentation - skid tester. GRA

N72-23229# Princeton Univ., N.J. Dept. of Civil and Geological Engineering.
A FIRST APPROXIMATION SATELLITE TERMINAL SYSTEM EVALUATION MODEL: PROGRAM USER'S INSTRUCTION MANUAL
Jack E. Snell Aug. 1971 96 p refs
(Contract DOT-W171-3579-1)
(AD-737334; FAA-AV71-4) Avail: NTIS CSCL 01/5

A program user's manual to be used for computer programming of the First Approximation Satellite Terminal System Evaluation Model described in Federal Aviation Administration Report FAA-AV-71-1. The latter is designed to analyze the cost effectiveness of off-airport or satellite terminals as a means of relieving groundside congestion in major hub cities. Author (GRA)

N72-23230# ARO, Inc., Arnold Air Force Station, Tenn.
VELOCITY MEASUREMENTS IN AERODYNAMIC WIND TUNNEL (IT) USING A LASER DOPPLER VELOCIMETER Final Report
F. H. Smith, A. E. Lennert, and J. O. Hornkohl AEDC Feb. 1972 47 p refs
(Contract F40600-72-C-0003; ARO Proj. BC5119)
(AD-737097; ARO-OMD-TR-71-108; AEDC-TR-71-165) Avail: NTIS CSCL 14/2

The report describes the application of a laser Doppler velocimeter (LDV) in a transonic wind tunnel. The LDV, an in-house-developed instrument, measured two velocity components using the dual scatter principle. The flow was not seeded for this test, and the output data was processed by a special data processor developed at AEDC. The velocity data and flow angularity are presented for five Mach numbers together with the velocities obtained using conventional wind-tunnel instrumentation. GRA

N72-23231# Naval Ordnance Lab., White Oak, Md.
THE USE OF A LASER DOPPLER VELOCIMETER IN SUPERSONIC FLOW
William J. Yanta, David F. Gates, and Francis W. Brown 25 Aug. 1971 28 p refs presented at the 6th AIAA Aerodynamic Testing Conf., Albuquerque, N. Mex., 10-12 Mar. 1971
(AD-737202; NOLTR-71-169) Avail: NTIS CSCL 14/2

Results are presented for an experimental program which investigated the application of an LDV technique in supersonic flows. This paper presents an analysis of the behavior of light-scattering particles in rapidly accelerating or shock decelerated flows, an evaluation of particle production techniques and the results of several velocity measurements. Measurements included the velocity distribution along the nozzle centerline and flow over a diamond airfoil in a Mach 3 tunnel and velocity profiles for a turbulent boundary layer in a Mach 4.8 facility. It is demonstrated that LDV measurements can be made consistently with errors of less than five percent if the particle lag is considered. Author (GRA)

N72-23232# Astro Industries, Inc., Santa Barbara, Calif.
HIGH TEMPERATURE, HIGH PRESSURE CRYSTAL GROWTH FURNACE Final Report, Apr. 1970 - Oct. 1971
Daniel F. Breedon Oct. 1971 10 p
(Contract F19628-70-C-0248; AF Proj. 5620)
(AD-737358; AFCRL-71-0542) Avail: NTIS CSCL 13/1

A unique resistance heated graphite furnace system was designed, manufactured and tested to provide specialized conditions for the growth of single crystals of refractory materials under conditions of high temperature, pressure and purity. The 6 inch diameter by 10 inch long furnace hot zone temperature is precisely maintained for uniform or gradient operation by three independently controlled heaters. The furnace chamber may be cycled during operation directly from high vacuum to pressures of 50 atmospheres, with operating temperatures up to 2800C. Special features include high purity insulation, automatic programmable operation, radial plus axial viewing ports, and a quick opening, hinged, full access door. Author (GRA)

N72-23233# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT Quarterly Bulletin, 1 Oct. - 31 Dec. 1971
31 Dec. 1971 97 p refs
(AD-737119; DME/NAE-1971(4)) Avail: NTIS CSCL 14/2

Contents: A wind tunnel and full-scale study of turbulent wind pressures on a tall building; Proposal for an engineering acoustic research laboratory; Non-ionizing electromagnetic radiation and pollution of the atmosphere. GRA

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N72-23234 Georgia Inst. of Tech., Atlanta.
AN EXPERIMENTAL INVESTIGATION OF A TURBULENT JET IN A CROSS FLOW Ph.D. Thesis
David Kenneth Mosher 1970 183 p
Avail: Univ. Microfilms Order No. 71-17339

The interference phenomenon occurring when a subsonic turbulent jet exhausts normally from a large flat plate into a low

speed cross flow was experimentally investigated in a nine-foot wind tunnel. Static pressures were measured on the surface around the jet. In the region off the surface, including the jet plume, wake and surrounding areas, the average total and static pressures and the average velocity magnitudes and directions were determined. Three jet exit configurations were studied, one circular and two slot-shaped, with width to length ratios of 0.3 and 3.4. Analysis of the data indicates that the pressure distributions induced on the surface are a combined result of the jet's blocking and entraining effects on the cross flow, with entrainment becoming the more dominant of the two as the effective velocity ratio is increased. Dissert. Abstr.

N72-23235 New York Univ., N.Y.
VELOCITY PROFILES FOR TANGENTIAL SLOT INJECTION IN TURBULENT INCOMPRESSIBLE AND COMPRESSIBLE FLOWS Ph.D. Thesis
Heywood Jay Saland 1970 91 p
Avail: Univ. Microfilms Order No. 71-18536

An analytical investigation for the flow field downstream from a tangential slot was carried out for incompressible and compressible turbulent flows. A unified approach was used which predicts the velocity profiles by the patching of turbulent power law profiles to mixing profiles obtained by an analogy to a jetmixing problem. The flow field consists of three characteristic regions: an initial mixing zone with a small wall boundary layer, an intermediate region, and a fully developed, turbulent boundary layer region. The analysis is valid for all three regions without the necessity of any strong assumptions to simplify the nature, or behavior of the flow field. Skin friction reductions were analyzed to highlight important trends and parameters.
Dissert. Abstr.

N72-23236 Tennessee Univ., Knoxville.
VISCOUS HYPERSONIC FLOW IN DIVERGENT, SLENDER AXISYMMETRIC NOZZLES Ph.D. Thesis
Kenneth Henry Token 1970 185 p
Avail: Univ. Microfilms Order No. 71-17779

An analytical investigation of internal flows is presented, in which both the pressure field and transportive effects are simultaneously considered. Restricted to compressible flow in nozzles having sharp leading edge inlets and inlet flows which are at least mildly hypersonic, equations of a higher order of approximation than the viscous slender channel equations were derived. Particularized to the axisymmetric case, implicit finite difference solutions were obtained for truncated conical nozzle geometries. The resulting predicted flow field is shown to be strongly affected by the interaction between the pressure field and the viscous layer which develops at the nozzle wall. An imbedded strong compression wave characteristic of internal flows having the nozzle geometry considered is shown to develop. Comparisons are made with an inviscid solution (method of characteristics) and experimental data. Dissert. Abstr.

N72-23237 Brandeis Univ., Waltham, Mass.
RELATIVISTIC SHOCK WAVES Ph.D. Thesis
George Lukas 1971 121 p
Avail: Univ. Microfilms Order No. 71-20338

A study of strong shocks, relevant to astrophysical situations, was made. There are three kinds of shock waves of particular interest, most easily classified by the state of the matter before and after passage of the shock. The three sets of conditions are: a cold gas downstream and a gas so hot upstream that matter thermal effects can be neglected in comparison to those of the radiation field; a cold degenerate electron gas-classical proton gas upstream and a warm degenerate electron gas-classical proton gas downstream; and a cold electron-proton gas upstream with a warm electron-proton gas downstream. A study of the dissipation mechanisms in and the structure of such shocks was made. Also the possibility of these shocks acting to erase magnetic fields which they move into was explored. Finally, shocks propagating into degenerate electron gases were studied.
Dissert. Abstr.

N72-23238 California Univ., Los Angeles.
PROPAGATION OF A SHOCK WAVE INTO NONUNIFORM FLUIDS Ph.D. Thesis
Michael Hsiang-teh Chen 1971 114 p
Avail: Univ. Microfilms Order No. 71-21319

A general numerical method is developed for the diffraction of a shock wave of arbitrary strength as it propagates into a nonuniform fluid. Application may be made to a variety of problems in fluid dynamics in which a shock front interacts with a nonuniform fluid region, such as wave propagation in a stratified ocean, the motion of a shock front along a channel of varying fluid properties, and the rate of return of a perturbed wave to a stable equilibrium profile. The examples presented here can be divided into two groups; one is the propagation and diffraction of a plane shock passing along an ocean surface, and the other is the stability and diffraction of a plane shock wave. Whitham's method is applicable throughout the whole flow field except at the interface for the former case; this is due to the increasing importance of re-reflected waves there.
Dissert. Abstr.

N72-23239 Purdue Univ., Lafayette, Ind.
APPLICATION OF THE SCALAR AND VECTOR POTENTIALS TO THE AERODYNAMICS OF JETS Ph.D. Thesis
Horace Laverne Russell 1971 147 p
Avail: Univ. Microfilms Order No. 71-20536

An analytical investigation was conducted to examine the applicability of a method based on the Stokes potentials (scalar and vector potentials) to computations associated with the aerodynamics of jets. The principal merits of the method were found to be that the aerodynamic field near the nozzle could be well represented and that the influence of a nonuniform velocity profile at the nozzle exit plane could be explictly determined. It provides the rationale for developing useful approximate analytical models for computations of the type considered. Computations were made for an axisymmetric jet exhausting into a quiescent atmosphere for the purposes of exploring the computational aspects of the method and for comparison with the available experimental data and other theories. Dissert. Abstr.

N72-23240 University of Southern Calif., Los Angeles.
HYPERSONIC WEAK-INTERACTION SOLUTIONS FOR FLOW PAST A VERY SLENDER AXISYMMETRIC BODY Ph.D. Thesis
Arthur Kent Cross 1971 76 p
Avail: Univ. Microfilms Order No. 71-16405

The Navier-Stokes hypersonic weak interaction theory is presented for the flow of a viscous, heat conducting, compressible fluid past a very slender axisymmetric body, when the ratio of the radius of the body to the radial thickness of the viscous region, produced and supported by the body, is much less than unity. The fluid is assumed to be a perfect gas having constant specific heats, a constant Prandtl number of order unity, and viscosity coefficients varying as a power of the absolute temperature. Solutions were studied for the free stream Mach number, the free stream Reynolds number based on the axial length of the body, and the reciprocal of the weak interaction parameter much greater than unity. Dissert. Abstr.

N72-23241 Yale Univ., New Haven, Conn.
AN EXPERIMENTAL INVESTIGATION OF TWO PHASE WEDGE AND PRANDTL-MEYER FLOW
Leo Thomas Smith 1970 118 p
Avail: Univ. Microfilms Order No. 71-16852

Two types of nonequilibrium supersonic flow involving phase change were studied experimentally and theoretically. The flow of a two phase mixture of air and very small ice particles through an oblique shock wave, produced by a wedge, was investigated. Measurements of oblique shock angle and curvature, obtained from schlieren and shadow photographs, were used to determine initial particle evaporation rates behind the shock. The experimental findings are in agreement with theoretical values computed for spherical particles in free molecular flow. A

qualitative study was made of corner expansion flow, with water vapor condensation occurring within the expansion fan. An empirical relation between experimentally determined adiabatic supercooling and expansion cooling rate was obtained.
Dissert. Abstr.

N72-23242 Minnesota Univ., Minneapolis.
NONSEPARATED FLOW ABOUT A BODY WITH A SHARP LEADING EDGE Ph.D. Thesis
Gary Lee Bowen 1971 114 p
Avail: Univ. Microfilms Order No. 71-22186

Several different sharp-edged, wedge-like bodies in a two-dimensional, incompressible, irrotational flow, and at zero cavitation number (based on cavity pressure) were examined using free streamline theory and the methods of complex variables. Two types of bodies were investigated experimentally and theoretically. One was a wedge-shaped body having tangential separation. Two examples of this type were investigated: a symmetrical wedge of 30 deg vertex angle and a similar 30 deg wedge with one face length half of the other. The other type of body was a wedge of 7 deg vertex angle with a flap or spoiler producing nontangential separation at one of the trailing edges. Two examples of this type were also tested. Dissert. Abstr.

N72-23243*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOLUTIONS FOR REACTING AND NONREACTING VISCOUS SHOCK LAYERS WITH MULTICOMPONENT DIFFUSION AND MASS INJECTION Ph.D. Thesis - Virginia Polytechnic Inst. and State Univ.
James Norvel Moss Oct. 1971 222 p refs
(NASA-TM-X-67708) Avail: NTIS HC $13.25 CSCL 20D

Numerical solutions are presented for the viscous shocklayer equations where the chemistry is treated as being either frozen, equilibrium, or nonequilibrium. Also the effects of the diffusion model, surface catalyticity, and mass injection on surface transport and flow parameters are considered. The equilibrium calculations for air species using multicomponent: diffusion provide solutions previously unavailable. The viscous shock-layer equations are solved by using an implicit finite-difference scheme. The flow is treated as a mixture of inert and thermally perfect species. Also the flow is assumed to be in vibrational equilibrium. All calculations are for a 45 deg hyperboloid. The flight conditions are those for various altitudes and velocities in the earth's atmosphere. Data are presented showing the effects of the chemical models; diffusion models; surface catalyticity; and mass injection of air, water, and ablation products on heat transfer; skin friction; shock stand-off distance; wall pressure distribution; and tangential velocity, temperature, and species profiles. Author

N72-23244*# Scripta Technica, Inc., Washington, D.C.
THE MOVEMENT OF A RIGID BODY WITH CAVITIES CONTAINING A VISCOUS FLUID Mathematical Methods in Spacecraft Dynamics, no. 7
F. L. Chernousko Washington NASA May 1972 213 p refs Transl. into ENGLISH of "Dvizheniye Tverdogo Tela s Polostyami, Soderzhashchimi Vyazkuyu Zhidkost" Moscow, USSR Acad. Sci. Computer Center, 1968
(Contract NASw-2036)
(NASA-TT-F-665) Avail: NTIS HC $3.00 CSCL 20D

The dynamics of a rigid body with a cavity containing a viscous liquid are treated. A general approach was developed for a number of important classes of motion to permit investigation and calculation of specific problems in the motion of liquid-filled bodies. Solutions are given for a number of problems in the dynamics of bodies with liquids. Author

N72-23245# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE ANALYSIS OF SUPERSONIC STEADY GAS FLOWS WITH INTERNAL COMPRESSION SHOCKS
V. I. Kosarev [1972] 10 p refs Transl. into ENGLISH from Vychisl. Matem. i Matem Fiz. (USSR), V. 11, no. 5, 1971 p 1262-1271
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The results are generalized for numerical experiments in the analysis of steady, supersonic gas flows of complex structure. The possibility is established for using certain difference schemes approximating stationary gas dynamic equations to analyze flows without extraction of low intensity internal compression shocks. Author

N72-23246# Lockheed Missiles and Space Co., Palo Alto, Calif.
ANALYSIS OF THE SELF-SIMILAR THREE-DIMENSIONAL LAMINAR BOUNDARY LAYER EQUATIONS BY THE METHOD OF QUASILINEARIZATION
V. A. Bashkin [1972] 8 p refs Transl. into ENGLISH from Vychislitelnaya Matem. i Matem. Fiz. (USSR), v. 11, no. 5, 1971 p 1338-1344
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A detailed numerical analysis is presented for the singular solutions of three-dimensional boundary layer equations in a Cartesian coordinate system. A method of quasi-linearization was used, for which the external flow parameters are dependent only on the longitudinal coordinate. Author

N72-23247# National Research Council of Canada, Ottawa (Ontario). Unsteady Aerodynamics Lab.
DYNAMIC VISCOUS PRESSURE INTERACTION IN HYPERSONIC FLOW
Kazimierz J. Orlik-Ruckermann 8 May 1972 87 p refs Backup document for AIAA Synoptic, "Oscillating Slender Cone in Viscous Hypersonic Flow", scheduled for publication in AIAA Journal in Sep. 1972
Avail: NTIS HC $6.50

A method is presented for the determination of the effect of a boundary layer on the unsteady pressure distributions of an oscillating body in continuum hypersonic flow. The method is here limited to low frequency and small amplitude oscillations. Calculated examples of oscillatory pressure distributions, phase angles, and stability derivatives are given for typical flow conditions over slender wedges and slender right circular cones performing oscillation-in-pitch about zero mean incidence and completely submerged in the weak interaction region of a laminar boundary layer. Closed form expressions are given for the inviscid unsteady pressure distribution on slender wedges and cones. The unsteady boundary layer displacement thickness of slender wedges and cones performing very small amplitude oscillation-in-pitch is analyzed. Comparison with experimentally obtained dynamic stability derivatives on slender cones is included. Author

N72-23248*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL AND PREDICTED CAVITATION PERFORMANCE OF AN 80.6 DEG HELICAL INDUCER IN HIGH TEMPERATURE WATER
George Kovich Washington May 1972 22 p refs
(NASA-TN-D-6809; E-6517) Avail: NTIS HC $3.00 CSCL 20D

The cavitating performance of a stainless steel 80.6 degree flat-plate helical inducer was investigated in water over a range of liquid temperatures and flow coefficients. A semi-empirical prediction method was used to compare predicted values of required net positive suction head in water with experimental values obtained in water. Good agreement was obtained between predicted and experimental data in water. The required net positive suction head in water decreased with increasing temperature and increased with flow coefficient, similar to that observed for a like inducer in liquid hydrogen. Author

N72-23249# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.

ARC TUNNEL FACILITY OF THE DFVLR-INSTITUT FUER ANGEWANDTE GASDYNAMIK

Martin Fiebig, Alfred Heyser, Manfred Becker, Knud Kindler, Wilhelm Neuberger, Demetrius G. Papanikas, and Klaus Stursberg 1971 78 p refs In GERMAN; ENGLISH summary

(DLR-Mitt-71-29) Avail: NTIS HC $6.00; DFVLR, Porz-Wahn: 21,0 DM

The arc tunnel facility and auxiliary installations are described. The four test legs of the facility are discussed with regard to massflow, pressure and specific stagnation enthalpy. The flow conditions in the different test legs and the measuring techniques are detailed. Author

N72-23250# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.

MEASUREMENTS OF AXIAL FORCES ON CONES IN VERY RAREFIED, ARC-HEATED NITROGEN FLOWS

Manfred Becker, Reazul Huq, Faruk Bachour, and Dieter Erdtel Sep. 1971 26 p refs Presented at the 28th Euromech-Colloq. on Spec. Topics in Low-Density Aerodyn., Brussels, Sep. 1971

(DLR-Mitt-71-27) Avail: NTIS HC $3.50; DFVLR, Porz-Wahn: 9,70 DM

In the regimes of shock formation and transition flow axial force measurements are discussed. The flow conditions are characterized by M sub infinity = 10-12 and lamba sub infinity = 1.5-5.5 mm. The current status of the investigations deals with effects of sting geometry, tip sharpness-bluntness ratio, and angle of attack on axial force measurements. Author

N72-23251# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Aachen (West Germany). Inst. fuer Theoretische Gasdynamik.

INTERACTION OF THERMAL RADIATION WITH THE FLOW IN A VISCOUS SHOCK LAYER

Wilhelm Schneider Oct. 1971 25 p refs Presented at the Euromech Colloq. 29 on High Temp. Gasdyn., Aachen, 12-14 Oct. 1971

(DLR-FB-71-89) Avail: NTIS

Recent investigations on the combined effects of radiation and low Reynolds number on the hypersonic flow over a blunt body are reviewed and completed. Regarding the fluid dynamical aspects of the problem it is concluded that the radiation term of the energy equation is important in the shock layer only and can be neglected in the shock structure, provided that the limiting case of very strong radiation is excluded. With regard to the radiation field it is shown that the processes of ionization and dissociation are almost completely frozen. Thus, equilibrium radiation is unimportant in this problem, and nonequilibrium radiation plays the dominant role. Author

N72-23252# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Luftstrahlantriebe.

INVESTIGATION OF TWO DIMENSIONAL SUPERSONIC CASCADE FLOW

H. Starken 1971 124 p refs In GERMAN; ENGLISH summary

(DLR-FB-71-99) Avail: NTIS; DFVLR Porz-Wahn: 35.80 DM

The special character of the two dimensional cascade flow at supersonic inlet velocities is discussed and the unique relationship between inlet Mach number and inlet flow angle is described in detail. An analytical and a graphical calculating method is presented and compared with experimental results in the Mach number range 1.0 less than or equal to M sub 1 less than or equal to 1.4. The flow in the blade passages is discussed with the aid of schlieren pictures and measured blade surface pressure distributions, and a simple correlation of the total pressure loss coefficient is derived. Author

N72-23253# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.

HEAT AND MASS EXCHANGE ON DROPLETS AT HIGH VAPOR PARTIAL PRESSURES AND HIGH VAPOR PARTIAL PRESSURE DIFFERENCES APPLIED TO AN INJECTION COOLER WITH PARALLEL FLOW

J. Nitschi 1971 128 p refs In GERMAN; ENGLISH summary

(DLR-FB-71-100) Avail: NTIS; DFVRL Porz-Wahn: 35.90 DM

The effect of a high portion of the condensable component in a gas-vapor-mixture on the gas-side heat transfer coefficient and the mass transfer coefficient of a droplet is investigated. This effect is also involved in the calculation of the Lewis coefficient. Moreover it is shown, that it is possible to represent the droplet-side heat transfer coefficient as a multiple value of the heat transfer coefficient of a droplet assuming pure heat conduction and negligable gas-side heat resistance by means of a suitable factor. Experiments were carried out to calculate this factor. Both the corrected gas-side transfer coefficient and the empirically obtained droplet-side transfer coefficient are used to calculate the variation of state of the gas to be cooled in an idealized injection cooler with parallel flow. The dependence of the variation of state on the most important parameters is presented. Author

N72-23254# Sandia Labs., Albuquerque, N.Mex.

SURFACE FLOW ANGLES ON AN OGIVE CYLINDER AT ANGLE OF ATTACK IN SUPERSONIC FLOW

Harold R. Vaughn and Oscar L. George, Jr. Dec. 1971 36 p refs Sponsored by AEC

(SC-RR-710781) Avail: NTIS

Surface flow direction was measured on a tangent ogive cylinder at angles of attack of 0, 2.6, 5.5, and 10.2 degrees at Mach numbers of 1.6, 2.0, and 2.5. These experimental results are compared with potential theory which is shown to be inadequate until modified. A single easily solved empirical equation which represents all the data is obtained. Author

N72-23255# Columbia Univ., New York.

COMPUTATIONAL STUDY OF SHOCK WAVES

C. K. Chu 1971 24 p refs Presented at Intern. Symp. on Dynamics of Ionized Gases, Tokyo, 13 Sep. 1971

(Contract AT(30-1)-3954)

(Conf-710921-2) Avail: NTIS

A direct numerical analysis of the Vlasov equation was used to study the formation of ion acoustic collisionless shocks. A time-dependent study was made of the formation and structure of one-dimensional collisional shock waves, in which all physical transport properties are included. A preliminary report is given on the reflection and focusing of hydromagnetic shock waves from a curved wall. NSA

N72-23256# Danish Atomic Energy Commission, Risoe. Research Establishment.

STUDIES OF TRANSPORT OF MASS AND ENERGY IN THE VORTEX TUBE. THE SIGNIFICANCE OF THE SECONDARY FLOW AND ITS INTERACTION WITH THE TANGENTIAL VELOCITY DISTRIBUTION Ph.D. Thesis - Copenhagen Univ.

C. U. Linderstroem-Lang Sep. 1971 117 p refs

(RISO-248) Avail: AEC Depository Libraries

The properties of the Ranque-Hilsch tube and related vortex tubes are reviewed. A unified description is attempted based on the literature available. A qualitative discussion is included on the characteristic temperature and concentration differences created between the two production streams. Also included are discussions on the interaction between rotational motion and secondary flow, and on the distribution of concentration and temperature within the tubes. Two-dimensional approximations, neglecting axial changes, are also discussed. A three-dimensional treatment is, however, essential for the understanding of the functioning of tubes working under optimum conditions, therefore the emphasis is put on three-dimensional theories and their

quantitative interpretation. Two aspects, e.g., separative work (for mass separation) and availability (for energy separation) are related to the flow dynamics of the tubes. The equivalence of the two functions is established and the relation between mass and energy separation is discussed. Author (NSA)

N72-23257# Sandia Labs., Albuquerque, N.Mex. Atmospheric Fluid Dynamics Div.

AIRBLAST WAVES FROM CONTAINED UNDERGROUND EXPLOSIONS

Jack W. Reed Dec. 1971 23 p refs Sponsored by AEC

(SC-RR-710612) Avail: NTIS

Relatively weak shock waves are induced into the atmosphere by ground surface motion above contained underground nuclear explosives (NE) bursts. Aircraft participating in experiments occasionally have received significant jolts from these waves. Methods were derived, combining theory and empiricism, for predicting these piston waves and establishing safe operating limits for air operations. Vertical cross-sections were prepared showing the range of 0.1 psi (7 mb) and 0.2 (14 mb) overpressures for 1 kt NE bursts in hard rock at various burst depths. Distance scaling rules for other yields are derived and shown. Author (NSA)

N72-23258# Rochester Univ., N.Y. Dept. of Physics and Astronomy.

PRODUCTION OF A HIGH DENSITY HYDROGEN GAS JET

D. A. Gross and A. Melissinos 2 Dec. 1971 52 p refs

(Contract AT(30-1)-875)

(UR-875-365) Avail: NTIS

The production of pulsed supersonic jets of H2 and He with densities of the order of 10 to the minus 7 power gm/cm3, for durations of 25-200 msecs, is described. The densities were measured with a constant temperature anemometer that was constantly self-calibrated in a static pressure mode by the determination of accommodation coefficients of the gases used. Such supersonic jets are to be used as internal targets in high energy experiments. Author (NSA)

N72-23259# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Porz (West Germany). Inst. fuer Angewandte Gasdynamik.

HYPERSONIC FREE JETS OF HIGH TOTAL ENTHALPY AND LOW DENSITY [HYPERSCHALLFREISTRAHLEN HOHER GESAMTENTHALPIE UND GERINGER DICHTE]

D. G. Papanikas Oct. 1971 32 p refs In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971

(DGLR-Paper-71-064) Avail: NTIS HC $3.75

Axisymmetric free jets are considered with initial velocity over Mach 5. Due to small static and environmental pressures and high stagnation temperature, the mean free path is of the order of a millimeter. The dynamic enthalpy flow density is high, and static temperatures are smaller than the environmental temperature so that cold free jets are considered. The initial flow profile is determined using pitot tubes and total enthalpy and velocity measurements. Results are presented for both laminar and turbulent axisymmetric argon free jets, and the flow profiles are discussed. Author (ESRO)

N72-23260# Institut Franco-Allemand de Recherches, St. Louis (France).

SHOCK PRESSURE REFLECTION AT THE OPEN END OF A SHOCK TUBE. PART 2: STUDY OF THE PARTIAL BLOCKING CAUSED BY ANNULAR OBSTACLES OR CONES [REFLEXION D'UNE GALERIE. 2 EME PARTIE: ETUDE DU BLOCAGE PARTIEL REALISE PAR DES OBSTACLES ANNULAIRES OU DES CONES]

G. Kronenberger and L. Bobin 16 Jun. 1971 83 p refs In FRENCH

(Contract DTAT-CEG-440/036/22/1970)

(ISL-12/71) Avail: NTIS HC $6.25

The effect of obstacles at the open end of a shock tube on the form of the shock wave both inside and outside the tube was investigated. The obstacles had a length greater than the diameter of the shock tube and up to two diameters, and included cones of different lengths and angles. It is shown that the length of the obstacle has virtually no influence. Similar intensity of reflected pressure waves was found for comparable obstruction whether the obstacle was annular or conical. Along the tube axis measurements of external noise showed a slight pressure increase and a marked decrease in pulse values with conical barriers; away from the axis, for identical obstruction, pressure and impulse were similar whatever type of obstacle was used. Wake visualization was used to examine the region near the tube opening, providing further justification for the mathematical model proposed previously. Author (ESRO)

N72-23261# Rutgers Univ., New Brunswick, N.J. Dept. of Mechanical and Aerospace Engineering.

SEPARATED FLOWS Final Scientific Report, 1 Sep. 1967 - 31 Aug. 1971

Robert H. Page Aug. 1971 72 p refs

(Contract F44620-68-C-0018; AF Proj. 7921-04)

(AD-733729; RU-TR-138-MAE-F; AFOSR-71-2325TR) Avail: NTIS CSCL 20/4

A comprehensive technical review of the Project THEMIS research program in Separated Flows, at Rutgers, is presented for the period from 1 September 1967 to 31 August 1971. Individual projects and associated personnel are listed, and the major results of each project are reviewed. Reference to available reports and publications is made in lieu of reviews of the research where appropriate. A chronological bibliography of all technical publications, AFOSR Scientific Reports, and graduate student theses is provided. GRA

N72-23262# Harry Diamond Labs., Washington, D.C.

ION AND ELECTRON DISTRIBUTIONS IN THE BOUNDARY LAYER OF HYPERSONIC VEHICLE FOR CHEMICAL NON-EQUILIBRIUM FLOW. PART 1: AERODYNAMICS AND NUMERICAL RESULTS

Irvin Pollin Nov. 1971 31 p refs

(AD-735318; HDL-TR-1565-Pt-1) Avail: NTIS CSCL 20/4

Flows over non-ablating hypersonic vehicles are considered when all electrons are produced by aerodynamic heating in the boundary layer. Detailed calculations of the ion and electron distributions are presented for a vehicle with a conical nose and a semivertex angle of 10 deg, for Mach numbers 8 and 10 at sea level. Except for a small region at the nose, the boundary layer is turbulent. Diffusion of electrons with respect to the ions and neutrals is considered and ambipolar diffusion is found to occur across most of the boundary layer only at large ionelectron densities. GRA

N72-23263# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.

AN ANALYTICAL STUDY OF THE SCRAMJET EXHAUST EXPANSION SYSTEM, PART 4 Final Technical Report, 1 Sep. 1970 - 31 Aug. 1971

Joe D. Hoffman and H. Doyle Thompson Wright-Patterson AFB, Ohio AFAPL Nov. 1971 48 p refs

(Contract F33615-67-C-1068; AF Proj. 3012)

(AD-736465; AFAPL-TR-67-142-Pt-4) Avail: NTIS CSCL 20/4

The research was designed to study the losses in a scramjet exhaust expansion nozzle and to develop methods of designing the exhaust expansion system to maximize the thrust or minimize the sum of the losses. The overall program includes a literature survey and the development of computer programs for the following purposes: to design optimized axisymmetric and plug nozzles accounting for boundary layer effects, to design axisymmetric nozzles with nonequilibrium chemical reactions, to design axisymmetric nozzles for gas-particle flows, to analyze isentropic flow in a three-dimensional nozzle, to analyze nonequilibrium, chemically reacting flow in three-dimensional

nozzles, and to design optimized three-dimensional nozzles. The design problems are formulated using variational calculus to obtain the maximum thrust; the problem constraints are imposed by using Lagrange multipliers. The results of the fifth and final year's effort are summarized. Author (GRA)

N72-23264# Hydronautics, Inc., Laurel, Md.
SCALING LAWS FOR CAVITATION EROSION
A. Thiruvengadam Dec. 1971 71 p refs
(Contract N00014-70-C-0204; NR Proj. 062-293)
(AD-736934; TR-233-15) Avail: NTIS CSCL 20/4

In the report, six scaling laws are derived and used to investigate the feasibility of modeling cavitation erosion. The velocity scale and size scale are studied with regard to six nondimensional ratios, namely: the erosion number, the relative nuclei size, the Weber number, the cavitation number, the cavitation inception number and the degree of cavitation. These scaling laws indicate that it is possible to model erosion in the laboratory and to predict the prototype performance. In addition, these scaling laws may be used to explain many currently available experimental observations. GRA

N72-23265# Naval Ship Research and Development Center, Bethesda, Md.
METHODS FOR COMPUTING FLUID LOADING AND THE VIBRATORY RESPONSE OF FLUID-LOADED FINITE RECTANGULAR PLATES SUBJECT TO TURBULENCE EXCITATION: OPTION 3
Ralph C. Leibowitz Sep. 1971 186 p refs
(AD-737203; NSRDC-2976C) Avail: NTIS CSCL 13/10

Various methods are presented for computing heavy or light fluid loading (i.e., added mass) of thin finite rectangular plates. Based on the results, preferred methods of computation are recommended. These methods and a corresponding computer program are of particular value in extending previously formulated digital computer programs for obtaining the vibroacoustic response to turbulence excitation of a plate. Computer results are given for a particular case involving the effect of fluid loading on the vibratory response of a plate subject to turbulence excitation. GRA

N72-23266# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
AN EXPERIMENTAL INVESTIGATION OF THE INTERACTION OF AN ACOUSTIC FIELD AND A PLANE TURBULENT JET Final Report
Kenneth F. Kaiser and Victor W. Goldschmidt Feb. 1971 116 p refs
(Contract DAAG39-67-C-0022; Grants NSF gk-2729; NSF GK-19317)
(AD-736854; HL71-P3) Avail: NTIS CSCL 20/4

An experimental study was conducted to determine the effect of a transverse acoustic wave on a two-dimensional turbulent jet. The investigation consisted of taking mean pressure profiles at numerous axial locations to determine the jet widening rate, the jet decay rate, and the geometric and velocity virtual origins. A method was also devised, employing four hot wires, to determine the jet widening rate more readily than was possible from a reduction of the pressure profiles. Author (GRA)

N72-23267# ARO, Inc., Arnold Air Force Station, Tenn.
AN EXPERIMENTAL INVESTIGATION OF SUBSONIC COAXIAL FREE TURBULENT MIXING Summary Report, Jul. 1966 - May 1971
D. E. Chriss and R. A. Paulk AEDC Feb. 1972 208 p refs
(Contract F40600-72-C-0003)
(AD-737098; ARO-ETF-TR-71-176; AEDC-TR-71-236; AFOSR-72-0237TR) Avail: NTIS CSCL 20/4

Turbulent coaxial air-air mixing and hydrogen-air mixing were studied. The ratio of outer stream to jet velocity was varied from 0.12 to 1.52 for the air-air mixing streams and from 0.16 to 0.42 for the hydrogen-air systems. Special emphasis was placed on the determination of the turbulent transport properties (especially the eddy viscosity and the Prandtl number) from the mean flow field measurements by use of an integral technique. Radial and axial profiles of velocity, concentration, shear stress, and eddy viscosity are presented, as well as radial profiles of the turbulent Prandtl number and representative static pressure profiles. GRA

N72-23268# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ULTRASONIC METHOD OF DETERMINING THE SHEAR RESISTANCE OF HYDRAULIC FLUIDS AND LUBRICATION OILS
Bogdan Wislicki and Wieslaw Karpinski Dec. 1971 34 p Transl. into ENGLISH from Prace Inst. Lotnictwa (Warsaw), no. 41, 1970 p 67-94
(AD-736885; FTD-HC-23-958-71) Avail: NTIS CSCL 11/8

A description is given of an ultrasonic method based on acoustically induced cavitation effects for studying the resistance of hydraulic fluids and lubrication oils to the action of mechanical shear forces. The effectiveness of the method was studied as a function of power (up to 200 W) and frequency (10,15, and 20 kHz) using acoustical concentrators in the form of an exponential horn, a disk ended exponential horn, a stepped cylindrical concentrator, and a chamber concentrator. Shearing efficiency was determined photographically. The ultrasonic method was compared for mineral and synthetic oils with pump slot techniques using injection pumps and gear pumps. The shear kinetics are analyzed, and relations are given for calculating viscosity on the basis of a given shear time. Author (GRA)

N72-23269# Naval Air Development Center, Johnsville, Pa. Aero-electronic Technology Dept.
HYDRODYNAMIC EFFECTS OF HARMONIC ACCELERATION Final Report
Roger A. Holler 11 Jan. 1972 48 p refs
(AD-736924; NADC-AE-7120) Avail: NTIS CSCL 20/4

Circular disks, cylinders, and tandem disks are oscillated in water and the hydrodynamic mass and damping determined. Correlation with the acceleration modulus and nondimensional amplitude of oscillation is shown. Equations are given for coefficients of hydrodynamic inertia, drag, and total resistance for disks and methods of application to sonobuoy suspension systems are outlined. Author (GRA)

N72-23270# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTROCHEMICAL MEASUREMENTS OF FRICTION IN A FLOW OF TRICKLING LIQUID
V. P. Popov, N. A. Pokryvailo, and L. K. Gleb 27 Nov. 1971 12 p refs Transl. into ENGLISH from Teplo- i Massoperenos (Minsk), v. 10, 1968 p 108-114
(AF Proj. 7343)
(AD-736901; FTD-HT-23-1213-71) Avail: NTIS CSCL 20/4

Recently works have appeared concerned with the measurement of viscous friction stress over the surface of a body by means of a controllable diffusion electrochemical reaction. The medium in which friction stress is measured by the given method is an electrolyte of special composition, while the sensor is an electrode (cathode) mounted flush with the surface on which the measurement is carried out. An electrochemical reaction occurs on the surface of the sensor; the rate of this reaction and, consequently, the force of current in the electrochemical cell are determined by the rate at which reacting ions are supplied by convective and molecular diffusion. Thus the friction can be determined. The report presents the mathematics of this technique. Author (GRA)

N72-23271# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GENERALIZATION OF SOME WELL-KNOWN METHODS OF CALCULATION OF BOUNDARY LAYERS IN NEWTON-

IAN FLUIDS TO THE CASE OF NONNEWTONIAN FLUIDS
Vladan D. Djordjevic 5 Nov. 1971 10 p refs Transl. into ENGLISH from Mat. Vesn. (Belgrade), v. 6, no. 3, 1969 p 277-281
(AF Proj. 7343)
(AD-736889; FTD-HC-23-1181-71) Avail: NTIS CSCL 20/4

The problem is considered of boundary layer flows in nonNewtonian fluids by using a modification of the well known methods of calculating boundary layers in Newtonian fluids by Goertler and Loitsianski. By generalizing the so-called Goertler's variable and Loitsianski's parameters, these methods are adapted to the case of pseudoplastic and dilatant fluids. The procedure makes it possible to calculate the boundary layers of these nonNewtonian fluids for arbitrary potential velocities.
Author (GRA)

N72-23272# Virginia Polytechnic Inst., Blacksburg.
COMPRESSIBLE THREE-DIMENSIONAL LAMINAR BOUNDARY LAYERS ON CONES AT INCIDENCE TO SHEAR AND AXISYMMETRIC WAKE FLOWS
G. L. Bordner and R. T. Davis Nov. 1971 46 p refs
(Contract F33615-70-C-1015)
(AD-736828; ARL-71-0262) Avail: NTIS CSCL 20/4

Solutions to three dimensional, compressible, laminar boundary layer equations were obtained for the cases of cones at incidence to nonuniform supersonic free stream flows. The boundary layer equations were placed in a Crocco-type form which makes use of similarity variables. A solution method is employed where the equations are converted to a finite difference form using a scheme which is stable for both negative and positive transverse velocities. The inviscid data used in the study are computer solutions and the cases include circular cones in shear flows and in axisymmetric wake flows. The results from several solutions of the exact boundary layer equations were compared with results from a small crossflow model. GRA

N72-23273# Norges Tekniske Vitenskapsakademi, Trondheim.
SPATIALLY VARYING FINITE-AMPLITUDE WAVE TRAINS ON FALLING LIQUID FILMS
Bjorn Gjevik 1971 19 p refs
(PB-206025; APS-ME-61) Avail: NTIS HC $3.00; Acta Polytech. Scand. Publishing Office, Box 5073, Stockholm: Sw. Kr. 10.00 CSCL 20D

A previous paper discussed the occurrence of steady finite-amplitude waves on falling liquid films are studied by a long wave expansion technique. The analysis is now extended to include spatially varying wave trains. The solutions presented may correspond to the forced wave trains downstream from a wave generator. The second order terms in the long wave expansion are reported and their effect on the finite-amplitude wave motion is studied. Numerical results for finite-amplitude waves on thin films of water or alcohol are presented. GRA

N72-23274# Southampton Univ. (England). Dept. of Aeronautics and Astronautics
TURBULENT PRESSURE FLUCTUATIONS IN WATER WITH ADDITIVES Final Report
A. Millward Sep. 1971 73 p refs
(Contract F61052-67-C-0086)
(AD-736634) Avail: NTIS CSCL 20/4

The pressure fluctuations at the wall beneath a turbulent boundary layer were measured for various concentrations of dilute polymer solutions to determine the effect of the polymer on the structure of the flow and to provide an insight into the mechanism causing the drag reduction which has been observed in such flows. The mechanism of drag reduction is explained in terms of a branching process involving energy transfer to the polymer molecules at an energy level which is lower than that of viscous dissipation. As a consequence of this mechanism there is also a reduction in the production of turbulent energy in order to maintain an equilibrium energy structure. Author (GRA)

N72-23275# TRW Systems Group, Redondo Beach, Calif.
BLAST WAVE TURBULENT BOUNDARY LAYERS Final Report, 4 Jan. - 3 Aug. 1971
Donald R. Crawford, Victor Quan, and John T. Ohrenberger Feb. 1972 73 p refs
(Contract DASA01-71-C-0042)
(AD-736694; TRW-18843-6001-RO-00; DNA-2768F) Avail: NTIS CSCL 19/4

Turbulent boundary layers induced by the flow fields generated by plane, cylindrical, and spherical Taylor-Sedov blast waves are studied using a two-thickness integral method. The method involves the use of the momentum integral and energy integral equations together with a similarity requirement which reduces the number of independent variables from three to one.
Author (GRA)

N72-23276# Tennessee Univ., Tullahoma. Space Inst.
ON THE NEAR FLOW FIELD GENERATED BY THE SUPERSONIC FLOW OVER REARWARD FACING STEPS Final Report
Jain-ming Wu, Michael W. Su, and Trevor H. Moulden Nov. 1971 176 p refs
(Contract F33615-70-C-1645; AF Proj. 7063)
(AD-736770; ARL-71-0243) Avail: NTIS CSCL 20/4

Measurements were made and evaluated in the oncoming boundary layer, in the free shear layer, the lip shock and in the wake (or reattachment) shock region. Pitot and static pressure surveys were conducted, along with hot wire measurements and flow visualization studies. The measured free shear layer profiles were compared at different free stream Mach numbers, Reynolds numbers and step heights. A new technique was established for reducing the hot wire data. This was based upon the heat transfer correlation formula, and allows a broader range of applicability; in both the low Reynolds number region and in the free shear layer where the flow field is changing rapidly. This technique when applied to the measurements allowed the flow structure in the recirculating region to be explored. The low base pressure generated by the step influences the flow field ahead of the step and the extent of this upstream influence has been discussed. A new base pressure correlation parameter has also been developed for fully laminar and transitional flow.
Author (GRA)

N72-23277# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
A THERMOHALINE CONVECTION MODEL
William R. Lindberg and Robert D. Haberstroh Nov. 1971 37 p refs
(Grant N00014-67-A-0299-0009; NR Proj. 083-250)
(AD-737288; TR-1) Avail: NTIS CSCL 20/4

The report presents a physical model to predict the gross flux parameters of steady, turbulent thermohaline natural convection between parallel, horizontal plates. The case treated involves addition of heat and salt at the bottom and removal of both in steady flow at the top of a system without layers of thermoclines. The boundary-layer stability model devised by Louis Howard for thermal natural convection is extended to give the 'thermal-burst' model of thermohaline-boundary-layer stability. A defined density Rayleigh number is used, along with physical reasoning, to give a simple stability criterion for the wall conduction layer. The predicted instability of the wall layer leads to calculations of the Nusselt and Sherwood numbers as well as to such details of the flow structure as temperature and concentration mean profiles and fluctuations. Author (GRA)

N72-23278# Ohio State Univ. Research Foundation, Columbus.
SURVEY OF SOME ASPECTS OF SWIRLING FLOWS Final Report
S. N. B. Murthy Wright-Patterson AFB, Ohio ARL Nov. 1971 313 p refs
(Contract F33615-67-C-1758; AF Proj. 7063)
(AD-737381; ARL-71-0244) Avail: NTIS CSCL 20/4

The survey on selected topics in the theory of swirling flows

in ducts is written as much from the point of view of clarifying and inter-relating the various aspects of the flow phenomena as to facilitate calculations pertaining to the design and performance of rotating flows in ducts. The particular topics discussed are wave motion, Taylor-Proudman column, vortex breakdown, turbulence and energy separation and transfer. The survey includes a detailed analysis of the equations of motion.
Author (GRA)

N72-23279# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.
THE ANALYSIS OF NONEQUILIBRIUM, CHEMICALLY REACTING, SUPERSONIC FLOW IN THREE DIMENSIONS. VOLUME 2: COMPUTER PROGRAM MANUAL Final Technical Report, 1 Sep. 1968 - 31 Aug. 1971
Michael C. Cline and Joe D. Hoffman Wright-Patterson AFB, Ohio AFAPL Dec. 1971 62 p
(Contract F33615-67-C-1068; AF Proj. 3012)
(AD-736467; AFAPL-TR-71-73-Vol-2) Avail: NTIS CSCL 20/4
In Volume 1 of the report a theoretical development for the analysis of nonequilibrium, chemically reacting, supersonic flow in three dimensions was presented. In Volume 2 the computer program that was developed is presented along with a discussion of its usage. The general program organization is discussed and a description of each subroutine is given. The input parameters for the program are presented and discussed. The description, data cards, and selected output for four sample cases are given.
GRA

N72-23612*# Scripta Technica, Inc., Washington, D.C.
DIFFERENCE METHODS IN SOLVING PROBLEMS OF GAS DYNAMICS
V. V. Rusanov *In its* Numerical Methods for Solving Probl. of Mech. of Continuous Media May 1972 p 5-34 refs (See N72-23611 14-19)
Avail: NTIS HC $3.00 CSCL 20D

N72-23613*# Scripta Technica, Inc., Washington, D.C.
METHODS OF SOLVING UNSTEADY PROBLEMS OF GAS DYNAMICS
B. F. Dyachenko *In its* Numerical Methods for Solving Probl. of Mech. of Continuous Media May 1972 p 35-59 refs (See N72-23611 14-19)
Avail: NTIS HC $3.00 CSCL 20D

N72-23616*# Scripta Technica, Inc., Washington, D.C.
NUMERICAL METHODS IN SOLVING STEADY-STATE EQUATIONS OF GAS DYNAMICS
O. M. Belotserkovskiy *In its* Numerical Methods for Solving Probl. of Mech. of Continuous Media May 1972 p 97-195 refs (See N72-23611 14-19)
Avail: NTIS HC $3.00 CSCL 20D

N72-23617*# Scripta Technica, Inc., Washington, D.C.
CERTAIN NUMERICAL METHODS FOR SOLVING EQUATIONS OF THE BOUNDARY LAYER
V. V. Shchennikov *In its* Numerical Methods for Solving Probl. of Mech. of Continuous Media May 1972 p 196-211 refs (See N72-23611 14-19)
Avail: NTIS HC $3.00 CSCL 20D

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N72-23280 Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
PROCEEDINGS OF THE PRINCETON UNIVERSITY CONFERENCE ON AEROSPACE METHODS FOR REVEALING AND EVALUATING EARTH'S RESOURCES
J. Preston Layton, ed. Jun. 1970 322 p refs Conf. held at Princeton, N. J., 25-26 Sep. 1969
Copyright. Avail: Issuing Activity
Conference papers are presented on the use of aircraft and spacecraft for sensing earth resources. The general topics covered are advanced remote sensor technology, aircraft and spacecraft systems, data management, data requirements from the user's standpoint, and economic and international aspects. For individual titles, see N72-23281 through N72-23300.

N72-23281*# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
FRAME TYPE IMAGING SENSORS c14
George Barna *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 20 p Sponsored by NASA (See N72-23280 14-13)
(NASA-CR-126422) Avail: NTIS HC $3.00 CSCL 08G
The salient features of TV cameras for sensing natural and man-made earth resources from an orbiting satellite are discussed. The performance requirements for space cameras specifically designed for earth resources are examined, and the television systems currently being developed for first generation earth resource satellite missions are described.
Author

N72-23282 Hughes Aircraft Co., Los Angeles, Calif.
SCANNING TYPE IMAGING SENSORS c14
Virginia T. Norwood *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 8 p (See N72-23280 14-13)
Copyright. Avail: Issuing Activity
Multispectral scanners for space observations of earth resources are discussed, and the ATS spin-scan and the ERTS scanners are described. Satellite orbits and their relationship to altitude and times to complete earth coverage are considered. The constraints on resolution imposed by diffraction effects and space attitude control are examined. Earth resources imaging tasks are listed, and orbits and scanners which will best perform the tasks are suggested. It is concluded that scanners are presently practical for signature analysis and high resolution photographs. No orbit is satisfactory for all tasks. The fine detail imaging at monthly to annual frequency should be assigned to low ERTS type orbits and the coarser detail imaging needed more frequently should be assigned to geostationary spin scanners which can iterate observation several times an hour if necessary.
Author

N72-23283*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PASSIVE MICROWAVE SENSORS c14
Warren Hovis *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 11 p ref (See N72-23280 14-13)
(NASA-TM-X-67710) Avail: NTIS HC $3.00 CSCL 14B
Characteristics of passive microwave sensors and results taken by sensors on Convair 990 flights are discussed. Emissivities of different ground materials and water as vapor, liquid, and ice are described and the problems created by surface roughness are covered. Photographs taken of an ocean, vegetation around rivers, and a populated area are given and their details are described.
N.E.N.

N72-23284 Barringer Research, Ltd., Rexdale (Ontario).
CORRELATION SPECTROMETRY APPLIED TO EARTH RESOURCES
Anthony R. Barringer *In* Princeton Univ. Proc. of the Princeton

Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 37 p (See N72-23280 14-13)
Copyright. Avail: Issuing Activity

Spectrometry from aircraft, balloons, and satellites is discussed for detecting minerals and oils, air pollution, and earth structural features. The emphasis is on gases, and in particular air pollutants: sulfur dioxide, nitrogen dioxide, mercury, and iodine. The association of certain gases with mines and mineral deposits and with marine life is described, and aerial detection of air pollution over cities and industrial areas is also discussed.
N.E.N.

N72-23285 General Electric Co., Philadelphia, Pa. Missile and Space Div.
TECHNOLOGICAL POSSIBILITIES OF THE EARTH RESOURCES PROGRAM
Daniel J. Fink *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 7 p (See N72-23280 14-13)
Copyright. Avail: Issuing Activity

Potential applications of satellites to the field of earth resources are discussed, and instrumentation is described. The problem is considered to be complex due to the broad range of disciplines involved and to the wide variety of ideas and interests of the participants. Remote sensors such as multispectral scanners, microwave sensors, correlation spectrometers and those for measuring polarized reflectance and very weak electromagnetic and gravitational fields are mentioned. The massive problem of data handling and the application of bionics to remote sensing are also considered.
N.E.N.

N72-23286*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MANNED SYSTEMS FOR SENSING EARTH'S RESOURCES c31
John E. Dornbach *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1972 35 p Original contains color illustrations (See N72-23280 14-13)
(NASA-TM-X-67711) Avail: NTIS HC $3.75 CSCL 14B

The Gemini and Apollo photography, Earth Resources Aircraft Project, Apollo Applications Program dry workshop, and the space station/space base are discussed, concentrating on the conceptual sensors involved. Details are given on the single-camera and multiband systems used on the Gemini and Apollo flights, and high altitude aircraft and Apollo 9 photographs in red, green, and near infrared, taken during the same days, are compared. Sensors on NASA and Earth Resources aircraft include multiband and mapping cameras, scatterometer and side-looking radar, microwave radiometer and imager, and infrared spectrometer and radiometer, and scanner. The AAP sensors experiments contain four to six vacuum-back cameras with matched lenses, multichannel scanners, active/passive microwave system, and an infrared spectrometer. Plans for the astronaut activity with sensors in the space station/space base mission are outlined.
N.E.N.

N72-23287*# National Aeronautics and Space Administration, Washington, D.C.
UNMANNED SPACECRAFT FOR SURVEYING EARTH'S RESOURCES c31
Theodore A. George *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 12 p (See N72-23280 14-13)
(NASA-TM-X-67712) Avail: NTIS HC $3.00 CSCL 22B

The technical objectives and payloads for ERTS A and B are discussed. The primary emphasis is on coverage of the United States and the ocean areas immediately adjacent, using 3-camera return beam vidicon TV system, 4-channel multispectral point scanner, data collection system, and wideband video tape recorder. The expected performance and system characteristics of the RBV system and the 4-band multispectral object plane point scanner are outlined. Ground station considerations are also given.
N.E.N.

N72-23288 International Business Machines Corp., Gaithersburg, Md. Federal Systems Div.
GROUND DATA PROCESSING CONSIDERATIONS FOR EARTH RESOURCE INFORMATION c08
Leonard E. Mumbower *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources 4 May 1972 26 p (See N72-23280 14-13)
Copyright. Avail: Issuing Activity

Most of the data from remote sensors mounted on aerospace platforms will be in image formats, and system techniques for processing this data are discussed. These techniques include collection control, image processing, storage and retrieval, data extraction, and user application. The concepts are based on the successful implementation of similar systems during the past several years and on the results of investigations which have analyzed the objectives and requirements for handling earth resource information. Most critical will be the area of data extraction. With all information in digital form, it is possible to improve the ability of the system to provide information tailored to the needs of the user and in a format for direct application to his area of interest.
Author

N72-23289 Radio Corp. of America, Hightstown, N.J. Ground Data Handling Systems.
USER DATA PROCESSING REQUIREMENTS c08
Herbert Gurk *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 15 p (See N72-23280 14-13)
Copyright. Avail: Issuing Activity

Processing techniques which are common to many users and special processing techniques are discussed, with emphasis on the latter. Special processing is illustrated with applications to use of ERTS data by the Tennessee Valley Authority and the Desert Research Institute. The major applications are forest inventory for the TVA and playa lake inventory for the DRI: land reclamation is also a major concern. Potential special processing techniques are identified as automatic analysis, interpretation aids, and data management. The requirements of partitioning, mosaicking, and presenting information at 1:250,000 scale of a smaller area are also discussed.
N.E.N.

N72-23290 Committee on Science and Astronautics (U. S. House).
AN EARTH RESOURCES SATELLITE SYSTEM IN A POLITICAL LIGHT c31
Joseph E. Karth *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 10 p refs (See N72-23280 14-13)
Copyright. Avail: Issuing Activity

Political aspects of the United States space program in general and of the ERTS program in particular are discussed. It is pointed out that the space accomplishments of the first ten years were political as well as scientific and technological. Today's climate is described as one of restraint and skepticism, partly because the United States has overcome the early Soviet lead and partly because the anxiety of possible military implications have dissipated. It is felt that a better balance between manned and unmanned programs must be achieved, with emphasis on improving the quality of life. The political background of ERTS is reviewed, and the reluctance of NASA to undertake the unmanned program and the Bureau of the Budget's demand for a cost-benefit analysis are mentioned. International implications are also considered.
N.E.N.

N72-23291 Geological Survey, Washington, D.C. Earth Resources Observation Satellite Program.
USER NEEDS IN GEOLOGY AND CARTOGRAPHY
William A. Fischer *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 24 p (See N72-23280 14-13)
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The data needs of geology and cartography, and the technological developments for acquiring and processing the data are discussed. The initial needs for acquiring data from space are defined as having the fewest possible variables, having the capability to assess change in many terms, and providing data in three specific bands. These bands are green, for seeing through water; red, for geological features and crop identification; and near infrared, for seeing water in contrast to seeing through water and seeing vigorous vegetation distriution. The uses of aerial and spaceborne photography are illustrated and the advantages of the latter in data quality and economy are described. Cartographic applications such as water distribution and soils maps are discussed, and it is felt that early applications will be more in the field of cartography than geology. The geological uses include recognition of deep-seated structures, definition of the thermal structure of the earth, and determination of the electrical composition or energy state of material from luminescence data. N.E.N.

N72-23292 Bureau of Commercial Fisheries, Galveston, Tex. Biological Lab.

OCEANOGRAPHIC DATA REQUIREMENTS FOR THE DEVELOPMENT OF AN OPERATIONAL SATELLITE SYSTEM

Robert E. Stevenson *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Method for Revealing and Evaluating Earth's Resources Jun. 1970 12 p refs (See N72-23280 14-13)

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Oceanographic data requirements for manned, orbital space systems in conjunction with surface exploration are described. Earth orbital sensor systems are needed to measure ocean color; sea-surface roughness; sea-surface temperature; slope of ocean surface and of significant waves; atmospheric profiles of temperature, moisture, and carbon dioxide; and lunar magnitude of tide-producing forces. Information available from Apollo photographs is illustrated, and it is felt that because of uncertainties of rates and magnitudes of change in ocean waters, the experimental space program requires man's discrimination in missions coupled with simultaneous oceanographic cruises. The major ocean areas with sites for prime surveys and calibration tests are listed. It is felt that technology exists for the development and implementation of earth resource satellite systems. N.E.N.

N72-23293 Department of Agriculture, Washington, D.C. Research Management Group.

USER NEEDS IN AGRICULTURE AND FORESTRY

A. B. Park *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 26 p (See N72-23280 14-13)

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The uses which will be made of spacecraft data by the various services of the Department of Agriculture are described, and the coverage requirements are listed for the individual services. These requirements are for soil, crop, and tree identification, water detection, land use, and surveillance activities. Camera and scanner data in infrared and visible regions are requested, and reasons for emphasizing the visible region are given. Experiments with different films and automatic mapping, and with different automatic processing techniques are described. N.E.N.

N72-23294 Connecticut Univ., Storrs.

SPACE ACQUIRED DATA: HYDROLOGICAL REQUIREMENTS

Paul Bock *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 8 p (See N72-23280 14-13)

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The needs for physical-mathematical models of the large-scale hydrologic cycle and coordinated hydrologic observational networks are described. The applications of space technology to hydrology are identified as basic studies of the hydrologic cycle, snow and ice mapping, surveys of coastal hydrologic features and large inland lakes, and real time communications of ground-based hydrologic data. Several remote sensing techniques were investigated, including panchromatic photography, TV, multispectral point scanning, infrared imagery, and radar imagery. These could provide data on snowpacks, ice and glaciers, water circulation, pollutant dispersions, and underwater detail in coastal waters, estuaries, lakes, and reservoirs. N.E.N.

N72-23295 United Nations, New York. Resources and Transport Div.

THE EXPLORATION OF NON-AGRICULTURAL NATURAL RESOURCES IN DEVELOPING COUNTRIES BY THE UNITED NATIONS

Joseph Barnea *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 6 p refs (See N72-23280 14-13)

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The work of the Economic and Social Affairs Department of the United Nations in exploring resources of economic significance is outlined. The main thrust is in the execution of projects in developing countries. Activities are reported on exploring for minerals (including copper and uranium), ground water, rivers and river basins, steam fields (geothermal energy), offshore petroleum, and offshore tin. N.E.N.

N72-23296*# National Aeronautics and Space Administration, Washington, D.C.

STATUS AND PROSPECTS OF INTERNATIONAL EARTH RESOURCES SATELLITE PROGRAMS

Arnold W. Frutkin *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 9 p (See N72-23280 14-13) (NASA-TM-X-67713) Avail: NTIS HC $3.00 CSCL 08G

The experimental and international aspects of the ERTS program are discussed. It is pointed out that the objectives of ERTS A and B are to assess the practical value of remote sensing from space, to compare the capabilities of spacecraft and aircraft, to determine if and how a space-assisted and user-oriented system should be pursued, to determine which sensors are most effective, and to develop data handling procedures. It is stressed that while there may be international spin-offs, especially for Canada, Mexico, and Brazil, the ERTS A system is primarily an experimental program directed to U.S. requirements. The question of how soon other nations will be prepared to use the data from ERTS A and B and subsequent programs is also discussed. Training programs for persons from other nations and the costs involved in acquiring and handling data are mentioned. Specific relations with France, India, and the UN, in addition to Canada, Brazil, and Mexico are described. N.E.N.

N72-23297 Princeton Univ., N.J.

ESTIMATING THE ECONOMIC BENEFIT OF SURVEYING EARTH'S RESOURCES

Klaus P. Heiss *In its* Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 13 p (See N72-23280 14-13)

Copyright. Avail: Issuing Activity

Details of the benefit cost analysis are discussed, and the analysis is applied to ERTS-EROS benefit estimates for agriculture and forestry. The estimates include possible prevention of diseases such as wheat rust, prevention of forest fires, and increased yields. The initial estimate of $36 billion from the ERTS program is considered to be unrealistic. The total increase through more efficient management, crop identification, better forecasting, and early detection of pests and forest fires is shown to be $240 million. N.E.N.

N72-23298 Earth Satellite Corp., Washington, D.C. Interdisciplinary Applications.

A WATER MANAGEMENT MODEL USING EARTH

RESOURCES SATELLITES
Allan H. Muir *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 15 p (See N72-23280 14-13)
Copyright. Avail: Issuing Activity

A systems analysis study is described that defined a complex and stringent set of requirements for an earth resources information system using satellite-based sensors, developed a concept for a satellite-assisted information system to meet these requirements that appear to be technically feasible for the mid-1970's, and evaluated the costs and benefits of deploying such a satellite system operationally. The analysis was oriented toward the practical application of the information from an operational remote sensing satellite system to critical management decisions that could benefit from repetitive, large-area coverage. The analytical framework was provided by developing a user-decision model, which permitted the information requirements, system concept, and cost-benefit analysis to be generated in cooperation with identified users of a satellite-assisted information system. It is believed that the study demonstrates that (1) substantial benefits can be realized from a satellite system capability, and (2) the methodology is applicable and appropriate for analyzing other major areas of information needs for earth resources management. Author

N72-23299 General Electric Co., Philadelphia, Pa. Missile and Space Div.
AGRICULTURAL RESOURCE INFORMATION REQUIREMENTS OF NONGOVERNMENTAL USERS
Harold G. Lorsch *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 17 p ref (See N72-23280 14-13)
Copyright. Avail: Issuing Activity

A survey was performed to obtain information on which to base a preliminary design for an aircraft/spacecraft-assisted agricultural resource informations system for nongovernmental users. It was found that remote sensing can satisfy many needs of the agribusiness community for information. Nongovernmental user information requirements are of greater variety than governmental requirements. The readiness to use remotely sensed information increases with the increase in the size of a user organization and its experience in electronic data processing. The preliminary survey showed that interviews are effective in identifying information requirements of agribusiness users.
Author

N72-23300 Princeton Univ., N.J. Woodrow Wilson School.
MANAGEMENT OF GRAZING LANDS BY EARTH RESOURCES SATELLITES
Charles R. Frank, Jr. *In its* Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 6 p (See N72-23280 14-13)
Copyright. Avail: Issuing Activity

The benefits of a satellite-assisted program for grazing land management are estimated, with particular reference to the needs of the Bureau of Land Management of the Department of the Interior and the Forest Service of the U.S. Department of Agriculture. The activities of the agencies and the value of the grazing land resource are described. The specific areas in which benefits might accrue are determined to be the use of satellite photographs as a substitute or supplement to aerial photographs, the use of camera images and spectral signatures to monitor deterioration in range conditions and determine the causes of deterioration, and the use of satellite data to provide forecasts of forage production for the individual rancher. The results of the cost benefit analysis indicate that an experimental earth resources satellite program is more than justified. N.E.N.

N72-23301 Columbia Univ., New York.
IONOSPHERIC BACKGROUND MOTIONS: RELEVANCE TO UPPER ATMOSPHERIC STRUCTURE AND GEOMAGNETIC MICROPULSATIONS Ph.D. Thesis
Hernan Abel Montes 1970 118 p
Avail: Univ. Microfilms Order No. 71-17526

The analyses showed that in the short period range there is often high correlation between phase-path variations and geomagnetic micropulsations of the Pi2 type. Cross-spectral analysis of these events indicated high coherence between the phase-path variations and the fluctuations of the NS magnetic component of a field-aligned system of coordinates. Analyses of microbarograph records from an array of microbarographs did not show any unusual infrasonic activity corresponding to these events. The coherence and phase results, the type of micropulsation associated, and the lack of infrasonic activity suggest that these ionospheric motions are produced by the modulation of the ionospheric plasma by transverse hydromagnetic waves propagating through the ionosphere along the magnetic field lines. In the longer period range, the power spectra of phase-path sounder records obtained simultaneously at three sounding frequencies show peak and slope breaks.
Dissert. Abstr.

N72-23302 California Univ., Berkeley.
A COMPARISON OF BALLOON AND SATELLITE OBSERVATIONS OF MAGNETOSPHERIC ELECTRON PRECIPITATION IN THE MIDNIGHT MERIDIAN Ph.D. Thesis
Richard Herbert Karas 1970 71 p
Avail: Univ. Microfilms Order No. 71-20831

A series of high altitude balloon flights from Fort Wainwright, Alaska, was carried out in September and October, 1968 in conjunction with high data-rate tracking of Vela satellite passes through the magnetotail. Observations of two magnetospheric substorms are presented in which the instruments lay on or near the geomagnetic midnight meridian. From ground based measurements in the auroral zone and satellite measurements at 6.6 R sub e and 18 R sub e, it is found that plasma in the distant magnetotail is convected earthward and stored, without precipitating, in the form of a partial ring current during the development phase of a substorm. The onset of a substorm begins deep within the magnetosphere, and appears to result from instabilities in the plasma convected inward during the development phase. Dissert. Abstr.

N72-23303 Wisconsin Univ., Madison.
A REMOTE SENSING TECHNIQUE USING TERRESTRIAL REFRACTION, FOR THE STUDY OF LOW LEVEL LAPSE RATE Ph.D. Thesis
James King Sparkman, Jr. 1971 176 p
Avail: Univ. Microfilms Order No. 71-16902

By use of an appropriate target placed one to five km from the observer, data can be obtained photographically of the nearsurface terrestrial refraction over the path. The role of the density profile is examined, where the surface is assumed to be thermally homogeneous, and layers of equal density taken to be horizontal above a flat Earth. A monotonic density profile is shown to permit approximation of a ray equation, and thus the profile distribution, i.e., the density kernel, is seen to be the dominating factor in refraction, and hence of the target appearance as seen or photographed. Dissert. Abstr.

N72-23304 Washington Univ., Seattle.
A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE ANTARCTIC EARTH-IONOSPHERE WAVEGUIDE AT VERY LOW FREQUENCIES Ph.D. Thesis
George Edward Webber 1971 197 p
Avail: Univ. Microfilms Order No. 71-24092

A comprehensive analysis of the Antarctic polar waveguide considers three basic areas of development. The first of these involves the application of a unique theoretical and experimental approach for describing the electrical properties of the lower boundary of the waveguide and ultimately relating these to the reflection coefficients for incident waveguide modes. A theoretical investigation is then made of the VLF fields excited by a horizontal dipole in the presence of an ice-covered ground and

an anisotropic ionosphere. The analysis is generalized to accommodate height gradients in the ionosphere. Finally the results of the initial two stages of development are then applied in formulating an experimental technique for describing average VLF reflection heights in the lower ionospheric D region.
Dissert. Abstr.

N72-23305*# Oregon Univ., Eugene. Center for Volcanology.
THE VISCOSITY OF MAGMATIC SILICATE LIQUIDS: A MODEL FOR CALCULATION
Yan Bottinga and Daniel F. Weill [1971] 70 p refs
(Grant NGL-38-003-020)
(NASA-CR-126381) Avail: NTIS HC $5.50 CSCL 08G

A simple model has been designed to allow reasonably accurate calculations of viscosity as a function of temperature and composition. The problem of predicting viscosities of anhydrous silicate liquids has been investigated since such viscosity numbers are applicable to many extrusive melts and to nearly dry magmatic liquids in general. The fluidizing action of water dissolved in silicate melts is well recognized and it is now possible to predict the effect of water content on viscosity in a semiquantitative way. Water was not incorporated directly into the model. Viscosities of anhydrous compositions were calculated, and, where necessary, the effect of added water and estimated. The model can be easily modified to incorporate the effect of water whenever sufficient additional data are accumulated.
Author

N72-23306# RAND Corp., Santa Monica, Calif.
FIFTY MORE TIMELY PROBLEMS OF THE ENVIRONMENT
L. M. Libby, comp. Mar. 1971 65 p
(P-4589) Avail: NTIS HC $5.25

Environmental problems of various sorts are discussed, including: building, pollution, mining, natural resources, environmental legislation, shipping, and energy sources. Possible topics of study are suggested based on the information available in newspaper articles concerning the subjects listed. K.P.D.

N72-23307# Committee on Science and Astronautics (U. S. House).
REMOTE SENSING OF EARTH RESOURCES
1972 233 p ref Presented at the 13th Meeting of the Panel on Science and Technology, 1972
Avail: SOD $1.25

Present and projected applications of remote sensing to studies of earth resources and the environment are considered. Data acquisition, processing, and dissemination are discussed. For individual titles, see N72-23308 through N72-23323.

N72-23308# O'Brien (Brian), North Woodstock, Conn.
REMOTE SENSING OF THE EARTH SURFACE FROM AIRCRAFT AND SATELLITES
Brian OBrien *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 19-23 (See N72-23307 14-13)
Avail: SOD $1.25

Principles of remote sensing of electromagnetic radiation from earth to sensor are discussed. Visible, infrared, and microwave types of radiation are considered. Electro-optical and photographic sensors are reviewed, as well as data transmission and handling. K.P.D.

N72-23309# Hughes Aircraft Co., El Segundo, Calif.
COMMENTS ON THE EARTH RESOURCES SENSING AND DATA ACQUISITION PROGRAM
Allen E. Puckett *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 25-41 (See N72-23307 14-13)
Avail: SOD $1.25

Effects of earth science and environmental quality discipline requirements are reviewed. Sensor development trends and their influence on sensor design, spacecraft platforms, and sensor data acquisition and communication elements for the support of the Earth Resources Observation and Management System are also discussed. K.P.D.

N72-23310# TRW Systems Group, Redondo Beach, Calif.
REQUIREMENTS AND TECHNOLOGY FOR OBSERVATIONS FROM SPACE
A. K. Thiel *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 43-81 (See N72-23307 14-13)
Avail: SOD $1.25

The capabilities of meteorological satellites in orbit and under development are considered. The objectives for remote sensor data in the late 1970's and early 1980's are discussed. Based on these goals, the types of technological improvement needed are predicted. Some examples are given of the relevance of remote sensing to administrative and legislative objectives.
K.P.D.

N72-23311# General Electric Co., Philadelphia, Pa. Space Div.
CURRENT CAPABILITIES, STATE OF THE TECHNOLOGY, AND FUTURE REQUIREMENTS
Daniel J. Fink *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 83-91 (See N72-23307 14-13)
Avail: SOD $1.25

Problems of remote sensing are considered; these include environmental monitoring, ocean monitoring, land use and resources management, and information extraction from data. The questions involved in acting upon the data received are discussed. K.P.D.

N72-23312# Interior Dept., Washington, D.C.
USERS, PROSPECTS, AND PLANS
W. T. Pecora *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 93-101 (See N72-23307 14-13)
Avail: SOD $1.25

Information needs are listed which can be met by remote sensing techniques. Future technological developments are discussed, and the Earth Resources Observation System and available facilities are reviewed. K.P.D.

N72-23313# California Univ., Berkeley. Space Sciences Lab.
THE FUTURE FOR REMOTE SENSING OF AGRICULTURAL, FOREST AND RANGE RESOURCES
Robert N. Colwell *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 103-117 (See N72-23307 14-13)
Avail: SOD $1.25

Potential users of remote sensing data and their informational requirements are considered. The use of remote sensing in the management of renewable resources, such as crops, forests, and range lands, is discussed. Various factors are presented which are involved in developing operational plans for the remote sensing of renewable resources. K.P.D.

N72-23314# Michigan Univ., Ann Arbor. Willow Run Labs.
THE DEVELOPMENT OF REMOTE SENSING OF EARTH RESOURCES
George J. Zissis *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 119-128 (See N72-23307 14-13)
Avail: SOD $1.25

The history and principles of remote sensing are presented. Present capabilities and areas of research are considered. K.P.D.

N72-23315# National Oceanic and Atmospheric Administration, Washington, D.C.
REMOTE SENSING OF EARTH RESOURCES AND

ENVIRONMENT
Robert M. White *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 129-136 (See N72-23307 14-13)
Avail: SOD $1.25

Remote sensing from space platforms and aircraft is discussed in relation to programs of the National Oceanic and Atmospheric Administration. K.P.D.

N72-23316# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
INTERNATIONAL IMPLICATIONS OF REMOTE SENSING
Norman H. Fisher *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 137-147 ref (See N72-23307 14-13)
Avail: SOD $1.25

Applications of remote sensing and implications for mineral exploration are discussed. The lower limit of outer space and the question of national control over air space are considered. Technical assistance to developing countries and the storage and distribution of remote sensing information are also dealt with. K.P.D.

N72-23317# United Nations Working Group on Remote Sensing of the Earth by Satellites, New York.
THE UNITED NATIONS AND THE REMOTE SENSING OF EARTH RESOURCES
Franco Fiorio (Italian Embassy) *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 149-156 (See N72-23307 14-13)
Avail: SOD $1.25

The activities of the United Nations Working Group on Remote Sensing of the Earth by Satellite are discussed. K.P.D.

N72-23318# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
IMPLICATIONS OF REMOTE SENSING IN THE UNDER-DEVELOPED NATIONS
Fernando DeMendonca *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 157-163 (See N72-23307 14-13)
Avail: SOD $1.25

The potential benefits that might be derived by underdeveloped countries through remote sensing applications are discussed. It is pointed out that remote sensors applied to agriculture give large-scale and quick benefits in soil research, in crop prediction, and also in the survey of available mineral resources which will contribute to the improvement of the areas and their cultivation. Particular reference is made to Brazil where remote sensing plays an invaluable role in pinpointing pest infected areas of coffee plantations. The various instruments used in remote sensing applications are reviewed and the techniques utilized with the instrumentation are discussed. D.L.G.

N72-23319# Ministry of Science and Education, Bonn (West Germany).
THE ROLE OF EARTH RESOURCES SATELLITES IN EUROPE
Armin Spaeth *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 165-167 (See N72-23307 14-13)
Avail: SOD $1.25

An overview is presented of current space projects in the Federal Republic of Germany and of the problems involved in establishing an earth resources satellite program. Limited amounts of funding and the lack of preparatory work are cited as the main obstacles. However, participation in the ERTS A and B program is expected to provide much of the necessary background technology. D.L.G.

N72-23320# Science Advisor to the President, Washington, D.C.
DATA HANDLING
Edward E. David, Jr. *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 169-173 (See N72-23307 14-13)
Avail: SOD $1.25

Data handling processes and their application to data received from ERTS A and B are discussed. The factors which must be considered in designing an effective data processing and management system are outlined. Particular emphasis is placed on selectivity in the collection and processing of data. It is pointed out that selectivity in examining pictures sent out by ERTS A could cut the job of photointerpretation by at least a factor of 10 and more likely a factor of 100 or 1000. D.L.G.

N72-23321# Sperry Rand Corp., Washington, D.C. Univac Div.
SPACE COMMUNICATIONS **c07**
Carl Hammer *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 175-195 (See N72-23307 14-13)
Avail: SOD $1.25

The processes involved in the transformation of raw data collected in space into useful scientific information are discussed. These processes include: (1) data generation and acquisition, (2) data transmission and reception, (3) data conversion and filtering, and (4) presentation and use of information. In addition, electronic data handling systems are discussed in terms of basic ingredients, real time operation, engineering principles, and facilities management. D.L.G.

N72-23322# Control Data Corp., Minneapolis, Minn.
IMAGE PROCESSING OF REMOTE SENSOR DATA
Robert L. Lillestrand *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 197-208 (See N72-23307 14-13)
Avail: SOD $1.25

Problems associated with the processing of imagery after its arrival at the ground processing center are considered. One of the basic problems discussed is that of estimating the amount of data which will be derived from remote sensing. Other problems examined are those involved in the creation of a coordinate-rectified data base. The role of digital computers in solving many of these problems is discussed. D.L.G.

N72-23323# International Business Machines Corp., Gaithersburg, Md.
REMOTE SENSING AND DATA HANDLING: THEIR APPLICATION TO WATER RESOURCES
Peter A. Castruccio *In* Comm. on Sci. and Astronaut. (U.S. House) Remote Sensing of Earth Resources 1972 p 209-220 (See N72-23307 14-13)
Avail: SOD $1.25

The current techniques employed in watershed management are discussed and the development of models to predict how much water will be available in a watershed as a function of rainfall is examined. It is pointed out that the present methods used for the gathering of these data requires costly instrumentation and are rapidly becoming too expensive from a cost effectiveness standpoint. It is concluded that remote sensing appears to hold the potential for a major step forward in cost performance. The benefits of applying remote sensing techniques to the determination of hydrologic regime of watersheds are considered to be: (1) improvement in predictive accuracy of already instrumented and modeled watersheds; and (2) the determination of the hydrologic regimes of as yet unknown watersheds, with potentially significant reductions in time, labor, and cost over present methods. D.L.G.

N72-23324*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIGNIFICANT ACCOMPLISHMENTS IN SCIENCES, 1970

Washington 1972 253 p ref Symp. held at Greenbelt, Md., 14 Jan. 1971 Original contains color illustrations
(NASA-SP-286) Avail: NTIS HC $3.00 CSCL 08G

Research papers on earth resources, meteorology, ionosphere, and interplanetary physics are reported. For individual titles, see N72-23325 through N72-23370.

N72-23325*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOLOGICAL FEATURES IN WYOMING FROM NIMBUS 1
Nicholas Short *In its* Significant Accomplishments in Sci., 1970 1971 p 2-7 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 08G

The identification of ground features in Nimbus photography by comparisons with geology, soils, and vegetation maps is discussed for the Wyoming-Colorado area. It is concluded that in a semiarid region, high topographic relief shows good coassociation with exposed geology and with vegetation and, to a lesser degree, with soils types. In lower, flatter basins, most tonal patterns are related to subtle variations in soil color and vegetation cover. It is thought that maps based on spectral parameters as the proper descriptor of surface features may be required. F.O.S.

N72-23326*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDROLOGY OF THE NIGER RIVER FROM NIMBUS HRIR
Norman MacLeod *In its* Significant Accomplishments in Sci., 1970 1972 p 8-13 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 08H

The seasonal changes in aspect of the Niger River in the Republic of Mali, West Africa, as seen in daytime imagery obtained by the high-resolution infrared radiometer on Nimbus 3 are described. The identification of different plants by their reflectance is shown to provide an ecological map that changes with time. It is concluded that Nimbus imagery provides an integrated view of the entire watershed on a daily basis. F.O.S.

N72-23327*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NIMBUS OBSERVATION OF OCEANIC UPWELLING
Karl-Heinz Szekielda *In its* Significant Accomplishments in Sci., 1970 1972 p 14-17 Original contains color illustrations (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 08C

Observing the development of upwelling on the northeast coast of Africa by measuring ocean surface emission with infrared radiometers on Nimbus satellites is reported. Using the temperature of the ocean as telemetered by the satellite, the biological potential of an area is estimated, and consequently the highest potential for fisheries. F.O.S.

N72-23328*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE EMISSION OF ARCTIC SEA ICE
Per Gloersen *In its* Significant Accomplishments in Sci., 1970 1972 p 18-21 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 08L

The feasibility of carrying microwave radiometers on Nimbus E and F missions for sea ice surveys was studied in the arctic using aircraft. It was found that passive microwave signatures of Arctic Sea ice relate specificaliy to the structure and type of ice. It is concluded that a new tool for conducting ice surveys from aircraft and satellites with remote sensors was discovered. F.O.S.

N72-23329*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE MEASUREMENTS OF SEA STATE
Thomas Wilheit *In its* Significant Accomplishments in Sci., 1970 1972 p 22-27 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 08C

Passive microwave measurements were studied for determining sea state. It was found that the brightness temperature increases due to the foam produced by winds, and that the surface wind can be determined by the brightness temperature. F.O.S.

N72-23330*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AIR-SEA INTERACTION IN THE PACIFIC OCEAN
Lewis J. Allison *In its* Significant Accomplishments in Sci., 1970 1972 p 28-31 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 08C

Daily Tiros and ESSA satellite television nephanalysis over the Pacific Ocean were collected, and monthly cloud charts drawn to study the interaction of tropical oceans with the atmosphere. The data were correlated with climatological data for rainfall and surface temperatures. F.O.S.

N72-23331*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLOBAL WINDS FROM NIMBUS TEMPERATURE DATA FOR JULY 1970 **c20**
Joseph S. Hogan *In its* Significant Accomplishments in Sci., 1970 1972 p 32-36 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 04B

Simulation studies to determine the best techniques for making use of vertical sounding temperature data are reported. An atmospheric model was developed to accept real SIRS radiance data from Nimbus 4 for June and July 1970. The results were compared to real observations. It was found that the model accepts real temperature data on a continuing basis, and real temperature data determine winds to a useful degree of accuracy. F.O.S.

N72-23332*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CLIMATIC MODIFICATION BY CO2, H2O, AND AEROSOL **c20**
Ichtiaque Rasool *In its* Significant Accomplishments in Sci., 1970 1972 p 37-42 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 04B

Research is reported on the effects of increasing the CO2, aerosols, and water content of the atmosphere on the surface temperature and climatology. An atmospheric model is described with the incoming solar radiation for a planetary albedo of 33 percent, surface temperature of 288 K, relative humidity of 75 percent, cloud cover of 48 percent, CO2 of 0.3 parts per thousand, and aerosol density of two million per square centimeter. The results show that if the CO2 increases by a factor of 1000 or more, the total pressure of the atmosphere increases, and the earth may become as hot as Venus. It is also shown that as the amount of dust particles in the atmosphere increases, the solar radiation decreases, and the surface temperature lowers. F.O.S.

N72-23333*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF PROBE AND RADAR IONOSPHERE TEMPERATURES
Walter Hoegy *In its* Significant Accomplishments in Sci., 1970 1972 p 43-45 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 04A

The discrepancy in temperature measurements of ionospheric electrons by Langmuir electrostatic probes, and radar backscatter are discussed. The discrepancy occurs at altitudes from 350 to 800km, and the probe temperatures are consistantly higher than the radar temperatures. It is concluded that the non-Maxwellian energy distribution provides an explanation for the altitude and the lower radar temperatures. F.O.S.

N72-23334*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE IONOSPHERE DURING A SUBAURORAL RED ARC
Eugene Maier *In its* Significant Accomplishments in Sci., 1970 1972 p 46-51 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 04A

The enhancements of the red 6300A line in the midlatitudes during maximum solar activity are discussed. From Explorer 31 and OGO-4 satellite data, electron and ion temperatures were obtained at altitudes of 880km and 2500km. It was found that there is an increased plasma temperature in the region of the optical emissions, a difference of 1000k between the plasma temperature at 880km and that at 2100km, and the ion temperatures are less than the electron temperatures. It is concluded that red arcs are observed only when there is heat flow from above, combined with decreased density caused by composition changes at the lower boundary. F.O.S.

N72-23335*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVIDENCE FOR THE TROUGH WIND c20
Henry Brinton *In its* Significant Accomplishments in Sci., 1970 1972 p 52-57 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 04B

The existence of an upward flow of ionization along trough-field lines located at approximately 65 deg magnetic latitude is discussed. A flux model that fits the observed behavior of h(+0) and O(+) was developed based on the existence of a trough wind. The measurements indicate a different behavior in the altitude distribution of ionized hydrogen in the plasmasphere as compared to the trough region. This difference is explained by the trough wind. F.O.S.

N72-23336*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRON IMPACT IONIZATION OF H
F. H. M. Faisal *In its* Significant Accomplishments in Sci., 1970 1972 p 58-62 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 04A

The results of theoretical calculations for the reactions between electrons and negative hydrogen atoms are discussed for an electron colliding with a negative hydrogen ion and neutralizing the hydrogen ion by stripping the loosely bound electron from it, and the two free electrons moving away. A semi-quantum description of the process is presented in which the target is described in terms of quantum mechanics, and the projectile electron is described in a classical fashion. F.O.S.

N72-23337*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STABILITY OF THE VENUS IONOPAUSE c30
Jay Herman *In its* Significant Accomplishments in Sci., 1970 1972 p 63-70 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

The ionopause of the Venus ionosphere, as indicated by Mariner 5 electron density data, and which occurs at 500km on the day side, and 2500km on the night side is discussed in terms of the solar wind interaction with the ionosphere. It is concluded that for a source of stabilization by heating to be effective, a small horizontal magnetic field is required to reduce the downward heat conduction of charged particles, and it has been shown that such a magnetic field is present. F.O.S.

N72-23338*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ADIABATIC INVARIANCE c30
David Stern *In its* Significant Accomplishments in Sci., 1970 1972 p 71-74 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

Theoretical work designed to bridge the gap between celestial mechanics and the motion of charged particles in magnetic fields is presented. Attempts are made to devise a simple uninvolved method to solve adiabatic invariant motion problems. The method is illustrated by solving a problem involving the motion of a slowly perturbed harmonic oscillator. E.H.W.

N72-23339*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETOSPHERIC RADIO NOISE c07
Michael Kaiser *In its* Significant Accomplishments in Sci., 1970 1972 p 75-80 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

Observations, made by the RAE satellite, of earth magnetospheric noise are reported. The observations show radio noise exists at 700 kHz and below. The results are included in graphs. E.H.W.

N72-23340*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETOSPHERIC BOUNDARIES
Donald Fairfield *In its* Significant Accomplishments in Sci., 1970 1972 p 81-85 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

The location of the outer boundary of the geomagnetic field, or magnetopause, and the location of the earth's bow shock have been compiled based on data from the first six IMP satellites. A.L.

N72-23341*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CRUSTAL ANOMALIES
Joseph Cain *In its* Significant Accomplishments in Sci., 1970 1972 p 86-91 ref Original contains color illustrations (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 08G

Crustal or magnetic anomaly component effects on Cosmos-49 and POGO measurements of the ambient geomagnetic field for North America are presented graphically. A.L.

N72-23342*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MASCON DISTRIBUTION ON THE MOON c30
James Murphy *In its* Significant Accomplishments in Sci., 1970 1972 p 92-97 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

Results concerning the distribution of mascons on the moon have been obtained from an analysis of Apollo 8, 10, 11, and 12 lunar orbit missions. It was concluded that the tugging and pulling by the moon on the orbit plane of the Apollo spacecraft yields qualitative information concerning the distribution of the mascons. A.L.

N72-23343*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEARCH FOR MAGNETIC MONOPOLES IN THE MOON c30
Kenneth Schatten *In its* Significant Accomplishments in Sci., 1970 1972 p 98-102 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

A search was made for the possible existence of magnetic monopoles on the moon using magnetic observations from magnetometer experiments on Explorer 33 and 35. A series of 37 orbital plots were analyzed and it was determined that the net number of magnetic monopoles was less than 1 per 10 to the 7th power cc. This is equivalent to the difference in the number of northern and southern magnetic monopoles within the moon being less than 1 per 10 to the 31st power nucleons. Searches for monopoles from lunar samples have also proven negative. A.L.

N72-23344*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUGER ELECTRONS **c24**
Lo I. Yin *In its* Significant Accomplishments in Sci., 1970 1972 p 103-106 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 20H

Results are briefly described of efforts undertaken to assign proper electron transitions to the Auger lines of copper. Based on these investigations, using X-ray excitation and higher resolution, all three prominent Auger peaks of copper were determined to be L3MM type rather than L2MM type. A.L.

N72-23345*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PERIODIC MOTIONS IN THE PROBLEMS OF THREE BODIES **c30**
Lloyd Carpenter *In its* Significant Accomplishments in Sci., 1970 1972 p 107-111 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03C

An example is given of the capture orbit for the general problem of three bodies and how it may be related to some practical problems in the solar system. A.L.

N72-23346*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY COSMIC DUST FLUX **c30**
Otto Berg *In its* Significant Accomplishments in Sci., 1970 1972 p 112-117 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

Pioneer 8 and 9 measured cosmic dust flux rate data are in agreement with astronomy theory, zodiacal light measurements, and ground-based observations, but differ markedly from the high flux rates deduced from earlier in situ measurements. As many as seven orders-of-magnitude separate the small particle end of the high and low flux curves. It was concluded that the data from the multicoincidence cosmic dust sensors have not only measured very low flux for micrometeorites, which is in keeping with astronomy theory, but have also shown how a high flux theory may be based on faulty data. A.L.

N72-23347*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GEGENSCHEIN AND DISTRIBUTION OF INTERPLANETARY DUST **c30**
Robert Roosen *In its* Significant Accomplishments in Sci., 1970 1972 p 118-124 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

Investigations to determine the source of the gegenschein indicated: (1) The gegenschein is an effect, not a thing, and is due to an increase in the reflectivity, near opposition, of dust particles in heliocentric orbits, and is not due to an accumulation of material near the earth. (2) The density of the reflecting particles increases outside the earth's orbit; therefore, it can be explained by dust produced by collisions between asteroids. A cometary origin for the material is considered unlikely. A.L.

N72-23348*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHOTOCHEMISTRY AND LIFETIMES OF INTERSTELLAR MOLECULES **c30**
Louis Stief *In its* Significant Accomplishments in Sci., 1970 1972 p 125-128 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

A quantitative discussion is presented of the lifetime against photodecomposition, or the probability of photodecomposition, of interstellar molecules. In addition to photodissociation, molecules can also be destroyed by interaction with high energy radiation and energetic particles. These processes are much less effective than destruction by ultraviolet radiation. However, when the ultraviolet is highly attenuated in clouds, the energetic radiation and particles will persist and will become relatively more important and the ultimate lifetimes in clouds may depend upon these processes. A.L.

N72-23349*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY SHOCK NORMALS **c30**
Ronald Lepping *In its* Significant Accomplishments in Sci., 1970 1972 p 129-133 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

A scheme has been developed to improve the estimate of an interplanetary shock normal by using both magnetic field and plasma data from a single spacecraft. Calculation of the basic shock model employs a subset of the eight magnetohydrodynamic conservation relations for a shock in an isotropic medium. This subset consists of six equations that are devoid of pressure and temperature terms. A sigma-weighted least squares loss function technique is used to best fit the overdetermination equations with respect to the eleven parameters of the system. This procedure usually yields a normal much more accurate than the one obtained using magnetic field values alone. An example is given of the use of the technique on the data for the Pioneer 7 shock of 29 August 1966. A.L.

N72-23350*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE STABILITY OF TANGENTIAL DISCONTINUITIES **c29**
Thomas Birmingham *In its* Significant Accomplishments in Sci., 1970 1972 p 134-139 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

Intuition regarding the stability of MHD tangential discontinuities of solar wind has been borne out by a linear stability analysis of the MHD equations. In performing the calculation, the model used had no plasma flow and thus corresponded to the solar wind rest frame. The method calculated the change in total energy, plasma plus magnetic, due to the perturbation. This type of stability analysis is analogous to the test of the stability of an equilibrium point in a mechanical potential. A.L.

N72-23351*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDROMAGNETIC HEATING IN THE SOLAR WIND **c29**
Richard Hartle *In its* Significant Accomplishments in Sci., 1970 1972 p 140-143 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

Hydromagnetic heating in the solar wind was investigated using the heating model in which fast-mode hydromagnetic waves propagate outward from below the base and deposit energy by collisionless damping. Ray paths were found by solving Hamilton's equations. As the ray propagates along its path, it will damp, supplying thermal energy to the solar wind gas. The strong agreement of these results with observations is clear indication that the primary nonthermal heat source in the solar wind is the collisionless damping of hydromagnetic waves. A.L.

N72-23352*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR WIND HEAT FLOW **c29**
Jack Scudder *In its* Significant Accomplishments in Sci., 1970 1972 p 144-148 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

The ability of a theoretical solar wind model to predict the energy flux density due to heat conduction was investigated. In order to demonstrate this capability, the analysis used simultaneous data from the electron plasma experiment of Ogilvie and Lind, and the vector magnetic field data of Heppner and Sugiura on OGO-5. On the strength of two independent, different, and consistent experimental determinations of the conduction of heat flux by electrons at 149.6 gigameters(1 AU), it was determined that the models for the solar wind must be able to predict a value for the heat conduction in the range 0.007 to 0.008 in order to be in agreement with the observations. A.L.

N72-23353*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOCATIONS OF SOLAR RADIO BURSTS **c07**
Richard Fitzenreiter *In its* Significant Accomplishments in Sci., 1970 1972 p 149-153 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

Measurements of the positions of the sources of solar radio bursts at decameter wavelengths, 20- to 60-MHz range, provide information about physical conditions in a region of the corona extending from about one-half to several solar radii from the surface of the sun. Position measurements in the 20- to 60-MHz range were made with the Clark Lake sweep-frequency grating interferometer. Although the resolution of the instrument is sufficient to measure source position accurately, the highly variable effect of refraction in the earth's ionosphere severely limits the observations, distorting position determinations to such an extent as to make much of the position data useless unless ionospheric refraction can be taken into account. A method was developed for the removal of the refractive effect from the data to permit determination of true source position. With this technique it is considered possible to measure spatial extent of radio sources that will provide information about emission processes and physical parameters in the corona. A.L.

N72-23354*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISCOVERY OF A HECTOMETRIC SOLAR CONTINUUM **c30**
Harriet Malitson *In its* Significant Accomplishments in Sci., 1970 1972 p 154-158 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

Solar continuum emission was detected in the hectometric range for the first time by RAE-1 satellite. Hectometric continuum is quite similar to decametric continuum, showing that the phenomenon extends out in the corona to at least 50 solar radii, or 36.4 gigameters(0.25 AU). An interesting point is that the amplitude distribution and the bandwidth of type 3 bursts associated with hectometric continuum are the same as those of type 1 bursts associated with the metric noise storm. It is believed that the storm radiation all the way from metric through hectometric can be accounted for by plasma wave radiation. This means that streams of superthermal electrons are continuously coming out of active regions and as they travel outward through the interplanetary medium, they produce plasma waves that result in metric, decametric, hectrometric, and probably kilometric storms. A.L.

N72-23355*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LONG DURATION SOLAR ACTIVE REGIONS **c29**
Donald Heath *In its* Significant Accomplishments in Sci., 1970 1972 p 159-163 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

Nimbus 3 and 4 observations of ultraviolet active regions of the sun have been investigated. It is not clear what is producing these UV-active regions, however, it could be changes in the overall intensity of the solar continuum near the region of the temperature minimum, or the solar flux variations that have been seen could be due to a continuous type of absorption like that associated with the ionization limits of elements such as aluminum, silicon, or magnesium. A.L.

N72-23356*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
QUASI-SEASONAL VARIATION IN THE SUN **c29**
Sushil Chandra *In its* Significant Accomplishments in Sci., 1970 1972 p 164-170 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

The results of an investigation on the effects of earth seasonal changes on solar activity, particularly sunspots, are given. These results show corpuscular and electromagnetic activity increased during the equinoctial months. In addition the electromagnetic aspect tends to increase during the winter months. It was suggested that seasonal changes in sunspot numbers may be caused by the tidal forces and the processional torques exerted by the various planets in the solar atmosphere. E.H.W.

N72-23357*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR X-RAYS AND PARTICLE ACCELERATION **c29**
Kenneth Frost *In its* Significant Accomplishments in Sci., 1970 1972 p 171-175 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

The process of solar flare acceleration of interplanetary particles, as measured by the fifth orbiting solar observatory, is explained. Data show the acceleration proceeds in two stages: (1) particle acceleration by induced electric fields arising from annihilating magnetic fields at the beginning stages of flares, and (2) a Fermi acceleration mechanism operating in a shock front produced by the flare. E.H.W.

N72-23358*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDROGEN/HELIUM RATIO IN STARS **c30**
David Leckrone *In its* Significant Accomplishments in Sci., 1970 1972 p 176-181 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

The ratio of hydrogen-to-helium in main sequence B stars is analyzed. An attempt was made to match each observed neutral helium profile with a theoretically calculated profile. Observational results show an overall average of helium-to-hydrogen is roughly between 10% and 11% by number of atoms. Detailed results of each star examined are given in graphs. Theoretical and calculated results are in reasonable agreement. E.H.W.

N72-23359*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ABSOLUTE ULTRAVIOLET STELLAR FLUXES **c30**
Dennis Evans *In its* Significant Accomplishments in Sci., 1970 1972 p 182-189 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

A study, made to calibrate the ultraviolet spectra of stars to within an absolute accuracy of 10%, is summarized. Data were taken by a 13 inch UVR telescope onboard several rocket flights. Calibrated and existing ground based data are in reasonable agreement. Calibrated results are presented in graphical form. E.H.W.

N72-23360*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GUM NEBULA **c30**
John Brandt *In its* Significant Accomplishments in Sci., 1970 1972 p 190-195 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03A

The distance from the sun to the center of the star, Gamma Velorium, is determined in an effort to draw a physical model and identify the ionized energy source of the Gum nebula. The distance is calculated from the local hydrogen density of radio astronomy studies and the hydrogen measure. E.H.W.

N72-23361*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRAL CLASSIFICATION OF X-RAY SOURCES
Peter Serlemitsos *In its* Significant Accomplishments in Sci., 1970 1972 p 196-199 (See N72-23324 14-30)
Avail: NTIS HC $3.00 CSCL 03B

The use of special detectors to measure and classify spectral X-ray sources in the region of a few keV and above, is discussed. Two sources, Cygnus X-2 and Cygnus X-3 were measured. E.H.W.

N72-23362*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRAL STRUCTURE OF THE DIFFUSE X-RAY SKY **c30**
Elihu Boldt *In its* Significant Accomplishments in Sci., 1970 1972 p 200-203 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

A description of diffuse celestial X-ray flux is drawn from data taken by rocket borne detectors. It was concluded that the diffuse flux is intra- and extra-galactic in origin and is caused by Compton scattering of .052 rad black body photons of relativistic electrons leaking out of the galaxies. E.H.W.

N72-23363*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA-RAY FLUXES **c30**
Donald Kniffen *In its* Significant Accomplishments in Sci., 1970 1972 p 204-208 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

The design and development of detectors to analyze gamma rays greater than 20 MeV are reported. Efforts were made to identify and verify the existence of galactic gamma radiation from the galactic disc, provide information on its spectral and spatial distribution, and determine the source of gamma ray emission from the galactic plane in the direction of the galactic center. Results verify the existence of gamma radiation from the galactic disc, indicate that limits are placed on the angular width of observed line intensity, and indicate a probable flattening of the energy below 100 MeV. E.H.W.

N72-23364*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THEORETICAL IMPLICATIONS OF GAMMA-RAY ASTRONOMY **c30**
Floyd Stecker *In its* Significant Accomplishments in Sci., 1970 1972 p 209-211 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03A

The measurement of cosmic gamma rays above 100 MeV by OSO-3 satellite and those from 1 to 6 MeV measured by the ERS-18 satellite are summarized. E.H.W.

N72-23365*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MUON PRODUCTION **c24**
Kaichi Maeda *In its* Significant Accomplishments in Sci., 1970 1972 p 212-216 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 20H

The production of muons by collisions of primary cosmic ray particles with air nuclei is discussed. From these collisions pions and kaons are produced which then decay into muons. Two cases, oblique incidence and vertical incidence, are analyzed theoretically. Theoretical calculations agree well with observed data. E.H.W.

N72-23366*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERSTELLAR ELECTRON INTENSITY **c30**
Reuven Ramaty *In its* Significant Accomplishments in Sci., 1970 1972 p 217-221 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

Two independent methods for measuring the electron intensity in interstellar space are proposed. The positron method involves the production of pions in proton-proton collisions, the decay of the pions into muons, and the subsequent decay of the muons into positrons. Results from detailed calculations of these processes are given in graphical form. The second method involves cosmic electron emitted synchrotron radiation in the interstellar magnetic field. These two methods are also used to analyze the spatial and temporal constancy of cosmic ray electrons in the galaxy. E.H.W.

N72-23367*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENERGY LOSS OF COSMIC RAYS IN THE INTERPLANETARY **c30**
Lennard Fisk *In its* Significant Accomplishments in Sci., 1970 1972 p 222-226 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

The problems associated with determining the loss of energy by interstellar cosmic ray particles as they pass through interplanetary space to earth are discussed. E.H.W.

N72-23368*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXTRAGALACTIC RADIO SPECTRUM **c30**
Larry Brown *In its* Significant Accomplishments in Sci., 1970 1972 p 227-230 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

An attempt was made to build a model for the observed continuous emission from extragalactic radio sources. The data, measured by RAE spacecraft, are compared to deduced measurements. The difference between the two is taken as the model for observed emission. Data also cover spectra for the anticenter, north halo minimum region, RAE low frequency observations, and ground based high frequency observations. E.H.W.

N72-23369*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A 100-MICROMETER (100-MICRON)MAP OF THE GALACTIC CENTER **c30**
William Hoffman *In its* Significant Accomplishments in Sci., 1970 1972 p 231-237 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

The results of a survey made of the galactic center by a balloon-borne telescope are reported. The telescope mapped far infrared emission over a 5 degree portion of the sky with overlapping scans perpendicular to the plane. Data show emission is a continuous band along the galactic plane and emission perpendicular to the plane is on the order of 2 degrees. The map covers, for the first time, the distribution of dust in the galactic plane. E.H.W.

N72-23370*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VERY LONG BASELINE INTERFEROMETRY **c30**
Thomas Clark *In its* Significant Accomplishments in Sci., 1970 1972 p 238-247 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03A

Some astronomical results, obtained by very long baseline interferometry, on quasi-stellar sources are reported. Data cover variations in optical luminosity, radio brightness variations, and observations of quasi-stellar nuclei. E.H.W.

N72-23371*# Geological Survey, Washington, D.C.
RECOGNITION ON SPACE PHOTOGRAPHS OF STRUCTURAL ELEMENTS OF BAJA CALIFORNIA
Warren Hamilton 1971 29 p refs Sponsored by NASA (NASA-CR-126391; USGS-PP-718) Avail: NTIS HC $0.45 CSCL 08G

Gemini and Apollo photographs provide illustrations of known structural features of the peninsula and some structures not recognized previously. An apparent transform relationship between strike-slip and normal faulting is illustrated by the overlapping vertical photographs of northern Baja California. The active Agua Blanca right-lateral strike-slip fault trends east-southeastward to end at the north end of the Valle San Felipe and Valle Chico. The uplands of the high Sierra San Pedro Martir are a low-relief surface deformed by young faults, monoclines, and warps, which mostly produce west-facing steps and slopes; the topography is basically structural. The Sierra Cucapas of northeasternmost Baja California and the Colorado River delta of northwesternmost Sonora are broken by

northwest-trending strike-slip faults. A strike-slip fault is inferred to trend northward obliquely from near Cabo San Lucas to La Paz, thence offshore until it comes ashore again as the Bahia Concepcion strike-slip fault. Author

N72-23372*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
OBSERVATIONS OF CHARGED PARTICLE PRECIPITATION OVER THE AURORAL ZONE DURING A MAGNETIC SUBSTORM
K. L. Ackerson Mar. 1972 51 p refs
(Contracts NAS5-10625; NAS1-8141; NAS1-2973; Grant NGL-16-001-002; Contract N00014-68-A-0196-0003)
(NASA-CR-126383; U-of-Iowa-72-7) Avail: NTIS HC $4.75 CSCL 03B

An array of sensitive electrostatic analyzers was launched on the satellite INJUN 5 into a nearly polar, low altitude orbit. A series of three traversals of the northern auroral zone in the local evening sector on 3 December 1968 has provided high energy- and time-resolution observations of low-energy proton and electron intensities within the energy range 50 smaller than E smaller than 15,000 eV before, during and after a polar magnetic substorm. The region of high intensities of plasma-sheet electrons expanded dramatically during the substorm, extending 3.5 deg farther poleward and approximately 4.5 deg farther equatorward relative to that of the preceding pass. Author

N72-23373*# Stanford Research Inst., Menlo Park, Calif.
DEVELOPMENT OF A WORLDWIDE MODEL FOR F LAYER-PRODUCED SCINTILLATION Final Report
E. J. Fremouw and C. L. Rino Nov. 1971 128 p refs
(Contract NAS5-21551; SRI Proj. 1079)
(NASA-CR-122392) Avail: NTIS HC $8.50 CSCL 03B

An empirical approach to modeling the electron-density irregularities in the F layer of the earth's ionosphere that are primarily responsible for scintillation of transatmospheric VHF-UHF signals has been devised and tested. The work was directed toward two major goals: first, development of a worldwide model for describing the rms fluctuation in signal strength to be expected on an arbitrary satellite-to-earth communication link under average ionospheric conditions; and, second, investigation of the feasibility of similar modeling for description of the complete first-order distribution of signal strength. Author

N72-23374# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE STATISTICAL STRUCTURE OF THE BRIGHTNESS FIELD OF REFLECTED RADIATION IN THE 0.6 - 0.8 MICRON SPECTRUM BAND
V. G. Boldyrev and V. I. Tulupov [1972] 7 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauch.-Issled. Tsentr SSSR (Leningrad), no. 73, 1971 p 118-125
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An analysis of the low-frequency oscillations was performed to study the oscillation spectrum of the radiation reflected from the earth's surface and clouds. The intensities of the reflected and scattered radiation in the 0.6 to 0.8 micron range were measured by the Cosmos 121 electrophotometer in the direction from the nadir. The instrument operated continuously for several days on the daytime side of the earth, and the information was recorded on motion picture film. The following deductions were made: (1) Ordered mesoscalar variations in the reflected radiation field and in the cloudiness field are apparently a rare phenomenon. (2) The spatial correlation functions of reflected radiation intensity referring to a mesoscalar spectrum range depend slightly on the kind of object reflecting the radiation. (3) Since the mesoscale oscillation contribution to the total variability of the radiation is small, averaging over approximately 1000 km areas is adequate for investigating large-scale energy processes. Author

N72-23375# Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL STUDY OF THE SPECTRAL TRANSMITTANCE OF THE ATMOSPHERE
Yu. I. Rabinovich and L. N. Guseva 27 Apr. 1972 10 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 118, 1961 p 69-76
(JPRS-55821) Avail: NTIS HC $3.00

The results obtained from spectral measurements of direct solar radiation in the visible spectrum range are examined. An analytical relationship between the spectral and overall transmittance coefficients is proposed. Author

N72-23376*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A GLOBAL EMPIRICAL MODEL OF THERMOSPHERIC COMPOSITION BASED ON OGO-6 MASS SPECTROMETER MEASUREMENTS
A. E. Hedin, H. G. Mayr, C. A. Reber, G. R. Carignan (Michigan Univ., Ann Arbor), and N. W. Spencer Mar. 1972 16 p refs Presented at 15th Meeting of COSPAR, Madrid
(NASA-TM-X-65878; X-621-72-103) Avail: NTIS HC $3.00 CSCL 04A

The analysis of composition measurements made with the neutral mass spectrometer aboard the OGO-6 satellite leads to the following conclusions. The measured atomic oxygen densities are generally in good agreement with those deduced from drag. The molecular nitrogen densities in the annual and semiannual variations depart significantly from those predicted by drag models and suggest similar departures for exospheric temperatures. The helium densities generally tend to vary in an inverse manner to the nitrogen densities. These composition changes are consistent with dynamical processes associated with the global circulation in the thermosphere. Author

N72-23377*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF INTERPLANETARY MAGNETIC FIELD AZIMUTH ON AURORAL ZONE AND POLAR CAP MAGNETIC ACTIVITY
J. L. Burch Apr. 1972 29 p refs Submitted for publication
(NASA-TM-X-65882; X-646-72-115) Avail: NTIS HC $3.50 CSCL 03B

During relatively quiet times in the period 1964-1968, AE is found to be greater when the interplanetary magnetic field (b sub IMF) is directed toward the sun in Jan., Feb., and Apr., and when B sub IMF is directed away from the sun in Oct. to Dec. Using Murmansk hourly H values and the AE components, AU and AL, it is shown that this sector dependence is present only in the negative H deviations. This observation supports the idea that negative bay magnitudes are determined chiefly by particle-produced ionization, while positive bay magnitudes are rather insensitive to increases in particle precipitation. The ratio of DP2-type magnetic activity in the southern polar cap to that in the northern polar cap is found to be greater by a factor of about 1.75 for B sub IMF toward the sun. Author

N72-23378*# Scripta Technica, Inc., Washington, D.C.
MORPHOLOGY OF THE QUIET AND DISTURBED IONOSPHERE
M. P. Rudina, ed. NASA May 1972 121 p refs Transl. into ENGLISH of the book "Morfologiya Spokoynoy i Vozmushchennoy Ionosfery" Alma Ata, Nauka Press of Kazakh SSR, 1970 p 1-116
(Contract NASw-2036)
(NASA-TT-F-688) Avail: NTIS HC $3.00 CSCL 04A

Various measurements on ionospheric disturbances and propagation affecting communication channels are discussed. Cosmic ray intensity, absorption spectra, and ionization inhomogeneities are also considered. For individual titles, see N72-23379 through N72-23398.

N72-23379*# Scripta Technica, Inc., Washington, D.C.
THE STATE OF THE IONOSPHERE ABOVE ALMA ATA
M. P. Rudina and N. F. Solonitsyna *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 1-6 refs (See

N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 04A

The basic patterns are described in the behavior of critical frequencies and minimum effective heights of the ionosphere's reflecting E, F1, and F2 layers, according to ionospheric recorder measurements from 1943 to 1967. The variations of critical frequencies and virtual heights are compared with the relative sunspot numbers and the flux of the sun's radio emission at 10.7 cm. Author

N72-23380*# Scripta Technica, Inc., Washington, D.C.
ON THE SELECTION OF A VERTICAL BASE IN THE IONOSPHERE
V. I. Drobzhev *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 7-12 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 04A

The problem of selecting a vertical base in the ionosphere that permits registration of vertical motions of small-scale ionization inhomogeneities of the ionosphere's F-region is discussed. The accuracy of calculation of the vertical drift-velocity component is estimated. Author

N72-23381*# Scripta Technica, Inc., Washington, D.C.
INFLUENCE OF VERTICAL DRIFT OF SMALL SCALE IONIZATION INHOMOGENEITIES ON THE DIURNAL VARIATION OF foF2
V. I. Drobzhev *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 13-16 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 04A

The diurnal variations of the critical frequencies of the ionospheric F2 region may be influenced substantially by the 12-hour component of the vertical drift of small-scale ionization inhomogeneities. The appearance of the forenoon maximum of F2 and the evening ionization maximum are examined. Author

N72-23382*# Scripta Technica, Inc., Washington, D.C.
IONOSPHERIC MAGNETIC PHENOMENA ASSOCIATED WITH PROTON FLARES
M. P. Rudina and N. F. Solonitsyna *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 17-22 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 04A

The state of the ionosphere above stations in Kazakhstan is examined in connection with the proton flares of 7 July, 28 August, and 2 September 1966. Universal time is used. It is established that a proton flare causes increased radio absorption (the ionization of the D-region is enhanced, and the minimum reflected frequencies decrease). Magnetic storms and ionospheric disturbances are observed on the earth one-and-a-half to two days after some proton flares. Author

N72-23383*# Scripta Technica, Inc., Washington, D.C.
PARAMETERS OF SMALL SCALE IONIZATION INHOMOGENEITIES IN THE F REGION OF THE IONOSPHERE
V. I. Drobzhev *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 23-29 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 04A

The results of the parameters of small-scale ionization inhomogeneities study of the ionosphere's F-region for October-November 1965 and January-February 1966 are presented. It is shown that the most probable values of the inhomogeneity parameters are as follows: degree of anisotropy 1.4-2; vertical dimension 200-400 m; horizontal dimensions along major and minor axes 400-1000 and 200-600 m, respectively; rate of chaotic motions 30-60 m/sec; lifetime 6-9 sec. Author

N72-23384*# Scripta Technica, Inc., Washington, D.C.
RADIOASTRONOMICAL MEASUREMENT OF ABSORPTION
T. K. Yakovets *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 30-34 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 04A

Diurnal and seasonal absorption curves measured by a radio astronomical method at Alma-Ata during the IQSY (1964-1965) are submitted. The apparatus is described. The dependence of absorption on solar flares is also indicated. Author

N72-23385*# Scripta Technica, Inc., Washington, D.C.
THE IONOSPHERE ABOVE ALMA ATA DURING A SOLAR ECLIPSE
M. P. Rudina and P. Ye. Kozina *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 35-38 (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 04A

The eclipse effect was manifested during the second phase: the ionization of the F1- and F2-layers decreased and the minimum effective heights of E and F2 increased due to recombination processes. The manner in which electron density is distributed over the levels was ascertained from analysis of N(t) curves. Author

N72-23386*# Scripta Technica, Inc., Washington, D.C.
APPARATUS FOR INVESTIGATION OF THE AMPLITUDE FREQUENCY RESPONSE OF THE IONOSPHERIC SCATTERING CHANNEL
V. M. Krasnov and A. F. Yakovets *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 39-45 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 04A

Equipment for studying the amplitude frequency response of the ionospheric scattering channel is described, having multipath signal propagation. Experimental results are reported, including nonuniformity in the channel's amplitude frequency response. Author

N72-23387*# Scripta Technica, Inc., Washington, D.C.
A METHOD OF INVESTIGATING THE PHASE RESPONSE CHARACTERISTIC OF THE IONOSPHERIC SCATTERING COMMUNICATIONS CHANNEL
A. F. Yakovets *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 47-54 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 04A

A method is proposed for measuring the phase difference fluctuations between vibrations at different frequencies that result from scattering properties of the medium. The measurement equipment is described, along with an ideal communication channel. Author

N72-23388*# Scripta Technica, Inc., Washington, D.C.
RADIO WAVE PROPAGATION AT FREQUENCIES EXCEEDING MUF-F2 IN THE SHORT WAVE BAND
Ya. F. Ashkaliyev and V. I. Bocharov *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 55-59 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 04A

The results of measurements of field strength and signal/noise ratio on experimental ionospheric-scattering short wave radio links are presented. It is shown that the seasonal and diurnal variations of field strength are determined by features of solar and meteoric activity. The role of the sporadic E-layer in propagation of short radio waves at frequencies exceeding MUF-F2 is noted. Author

N72-23389*# Scripta Technica, Inc., Washington, D.C.
OCCUPANCY OF THE RADIO FREQUENCY SPECTRUM IN THE 16-23 MHz BAND
Ya. F. Ashkaliyev and V. I. Bocharov *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 60-64 (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 04A

Measurement results are presented for actual utilization of

the short wave frequency band, obtained by continuous registration of the number of radio stations in the 16-23 MHz band over an annual cycle (1965). It is shown that there is a relation between the number of radio stations and the variations of MUF-F2. During years of minimum solar activity and at night, segments free of radio stations operating by normal reflection, can be selected in the 18-23-MHz band for ionospheric-scattering links. Author

N72-23390*# Scripta Technica, Inc., Washington, D.C.
RECEIVING ANTENNA INSTALLATION FOR IONOSPHERIC SCATTERING LINKS
Ya. F. Ashkaliyev *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 65-68 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 04A

Smearing of the scattered-energy flux density over a range of angles of arrival permits the use of a receiving-end antenna with a height lower than theoretical. Author

N72-23391*# Scripta Technica, Inc., Washington, D.C.
INPUT OF INFORMATION RECORDED ON MAGNETIC TAPE IN THE BESM-3M COMPUTER **c08**
E. L. Afraymovich, G. M. Kudelin, and G. M. Pelenitsyn *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 69-73 (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 09B

An input unit designed for the BESM-3M general-purpose digital computer is described. The input unit uses a standard MEZ-28A studio tape recorder. An automatic data-input subroutine is presented. Author

N72-23392*# Scripta Technica, Inc., Washington, D.C.
COSMIC RAY VARIATIONS DURING PCA TYPE ABSORPTION **c29**
I. D. Kozin *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 74-77 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 03B

It is shown based on data on the cosmic-ray neutron component, ionospheric soundings, and measurements of cosmic radio-emission absorption at Vostok station (Antarctica) that the ionization of the lower ionosphere increases during low intensity of Forbush-type cosmic rays. This is manifested in increased absorption and the appearance of strong sporadic layers in the E-region. Author

N72-23393*# Scripta Technica, Inc., Washington, D.C.
STATISTICAL ACCURACY OF COSMIC RADIATION NEUTRON COMPONENT RECORDERS **c29**
L. I. Dorman and I. A. Pimenov *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 79-81 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 03B

A method is examined for calculating the error of experimental data from a standard neutron monitor with the multiplicity of neutron generation. It is shown that use of the Poisson distribution to estimate the real statistical error is inadequate. The method proposed is for analysis of low-amplitude periodicities in the cosmic-ray variations. Author

N72-23394*# Scripta Technica, Inc., Washington, D.C.
ESTIMATES OF THE ELECTRIC FIELDS IN THE LOWER IONOSPHERE ABOVE THE MAGNETIC EQUATOR
V. N. Pogrebnoy and M. N. Fatkullin *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 82-89 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 04A

The electric fields at the solar activity minimum on the magnetic equator are evaluated based on data from rocket studies of the vertical profiles of the ionospheric-current magnetic fields and electron concentration. The electric field strength is 1-4 X 100 CGSM units. In addition, the electric field has altitude and time distributions. Its maximum is observed at a height of 110 km, and at 90 and 140 km, it is smaller by a factor of 3-4 than at the 110-km height. The maximum values are registered around noon. Author

N72-23395*# Scripta Technica, Inc., Washington, D.C.
ON THE POSSIBILITY OF EXPLAINING FEATURES OF THE LATITUDE VARIATIONS OF Sq(H) AND Sq(Z) IN THE EQUATORIAL REGION BY ELECTRICAL MODELLING
V. N. Pogrebnoy, G. I. Gordiyenko, and B. T. Zhumabayev *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 90-94 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 04A

Curves of H (the horizontal component) and Z (the vertical component) of the magnetic field from a strip with an assigned current-density distribution compiled from the results of electrical modelling are calculated. The calculated curves are compared qualitatively with latitude curves obtained from ground magnetic observatory data. It is shown that the forms of the theoretical H and Z and the experimental latitude variations are qualitatively similar. Author

N72-23396*# Scripta Technica, Inc., Washington, D.C.
ON THE RESOLUTION OF THE STANDARD ALGORITHM FOR COSMIC RAY STATIONS **c19**
I. A. Pimenov *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 95-98 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 12A

It is shown that resolution increased with increasing averaging interval. This is accompanied by an increase in the uncertainty with which the standard algorithm for cosmic ray stations is localized. Author

N72-23397*# Scripta Technica, Inc., Washington, D.C.
RESULTS OF MEASUREMENT OF RADIO WAVE ABSORPTION IN THE IONOSPHERE BY THE AI METHOD **c07**
N. A. Korinevskaya *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 99-112 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 17B

Median noon absorption values for each month from 1964 through 1967, the diurnal variations of absorption on the regular world days, and the seasonal variations of absorption are given. The dependence of the absorption coefficient on sunspot number is analyzed. Author

N72-23398*# Scripta Technica, Inc., Washington, D.C.
VARIATIONS OF COSMIC RAYS ASSOCIATED WITH CHROMOSPHERIC FLARES ON THE SUN **c29**
I. D. Kozin *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 113-116 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 03B

Features of the cosmic-ray variations in the geomagnetic pole region and a smooth decrease in the cosmic rays intensity as a result of increased solar activity are reported. A 66-day variation of the cosmic rays was registered, in agreement with the maximum frequency and power of solar chromospheric flares. Author

N72-23399*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
PROBLEM OF PHOTOCHEMICAL EQUILIBRIUM OF OZONE IN PLANETARY ATMOSPHERES: OZONE DISTRIBUTION IN THE LOWER ATMOSPHERE OF MARS
Gerald Grams (Natl. Center for Atmospheric Res.) and Shardanand Washington May 1972 20 p refs
(NASA-TN-D-6812; WI-100) Avail: NTIS HC $3.00 CSCL 04A

The inherent errors of applying terrestrial atmospheric ozone

distribution studies to the atmosphere of other planets are discussed. Limitations associated with some of the earlier treatments of photochemical equilibrium distributions of ozone in planetary atmospheres are described. A technique having more universal application is presented. Ozone concentration profiles for the Martian atmosphere based on the results of the Mariner 4 radio occultation experiment and the more recent results with Mariner 6 and Mariner 7 have been calculated using this approach. Author

N72-23400# National Aviation Facilities Experimental Center, Atlantic City, N.J.

A STUDY OF ATMOSPHERIC IONIZATION: MEASUREMENTS OF THE ION CONDITIONS IN AN ATC LABORATORY AND A REVIEW OF THE LITERATURE OF ION EFFECTS ON PERFORMANCE Final Report

Bruce L. Rosenberg May 1972 69 p refs
(Proj. 198-001-01X; Proj. 215-201-01X)
(FAA-NA-72-19) Avail: NTIS HC $5.50

Irritating sensations affecting the face, nose, and eyes when working at ATC radar positions were reported. The possibility was considered that an atmospheric ion imbalance, due to the high voltages present on the equipment could be the cause of the observed sensations. Ion densities for four mobility ranges were measured in several locations outside and inside a laboratory containing operating radar display equipment during the summer of 1970. Although the inside total ion density was low, a significant percent excess charge for very small ions was found in the vicinity of the RBDE-5 radar displays. The imbalance, in favor of positive ions, exceeded +33 percent. This positive imbalance, possibly the cause of the irritating sensations, might be due to the 20 kilovolt positive accelerating potential used for the displays. The thresholds for the onset of deleterious effects of positive ions were tentatively defined. The importance of atmospheric ionization as an environmental factor relevant to the mission of the Federal Aviation Administration was documented. Author

N72-23401# Joint Publications Research Service, Washington, D.C.

BASIC FEATURES IN METALLOGENY OF NORTHEASTERN PART OF PACIFIC BELT (NORTHWEST CORDILLERAS AND ALASKA)

V. I. Berger and M. I. Itsikson 4 May 1972 24 p refs Transl. into ENGLISH from Sov. Geol. (Moscow), no. 1, 1972 p 90-106
(JPRS-55884) Avail: NTIS HC $3.25

An analysis of the metallogenic features of Alaska and the Canadian Cordilleras is presented, in order to provide a basis for prediction of ore-bearing regions in the eastern USSR. Tectonic, metallogenic, and geologic charts are included. A geologic history of ore formation and metallogenic deposits is also presented. The duration and complexity of the process involved in developing endogenic deposits in the Northwestern Cordilleras and Alaska was established; this process was a result of the repeated redistribution of ore elements. K.P.D.

N72-23402# Brookhaven National Lab., Upton, N.Y.

PHENOMENA ACCOMPANYING EARTHQUAKES AND THE PROBLEM OF THE PREDICTION OF EARTHQUAKES. OPTICAL AND ELECTRIC EFFECTS ACCOMPANYING THE EARTHQUAKES

D. M. Zakharovskaya, ed. 1971 18 p Transl. into ENGLISH of ch.5 of the book "Tashkentskoye Zemletryasenie, 26 Apr. 1966" Tashkent, FAN, 1971
(BNL-TR-460) Avail: NTIS

Water samples taken at the mouth of a deep hole in the vicinity of an earthquake region were studied for changes in radon concentration. It was found that plastic relaxation and relaxation and deformation of rocks by shocks increased radon concentration in thermomineral water and thus is an indication of an impending cataclysmic event. Release of radon caused a certain illumination of the surrounding area. Analysis of ionospheric data obtained suggested a certain dependence of the cutoff frequency rise in the E layer on earthquake activities. G.G.

N72-23403# Westinghouse Research Labs., Pittsburgh, Pa.

LIGHTNING INDUCED BY THERMONUCLEAR DETONATIONS

M. A. Uman, D. F. Seacord (EG and G, Inc., Bedford, Mass.), G.H. Price (Stanford Res. Inst., Menlo Park, Calif.), E. T. Pierce (Stanford Res. Inst., Menlo Park, Calif.), and R. E. Holzer (Calif. Univ., Los Angeles) [1971] 19 p refs Sponsored by AEC
(TID-25846) Avail: NTIS

The lightning flashes induced by a thermonuclear detonation at Eniwetok Atoll in the Pacific in 1952 are described. The five discharges were upward-propagating and were apparently initiated from instrumentation stations slightly above sea level. The likely mechanism for the necessary charge and electric field generation, Compton electrons produced by gamma rays from the detonation, is explored quantitatively. The electric field intensity calculated, 30,000 V/m, is near the value needed to initiate lightning from surface projections. The charge estimated to be available, however, appears to be insufficient to account for the observed lightning. Author (NSA)

N72-23404# National Radiation Lab., Christchurch (New Zealand).

ENVIRONMENTAL RADIOACTIVITY IN NEW ZEALAND Quarterly Report, Apr. - Jun. 1971 and Pacific Area Monitoring, 4 Jun. - 31 Aug. 1971

31 Aug. 1971 28 p
(NRL-F-45) Avail: AEC Depository Libraries

The results of routine monitoring of radioactive fallout in New Zealand during the second quarter 1971 are presented. Extended monitoring operations during the French nuclear tests in the South Pacific started on 4 June and results are given for all samples measured up to the end of August. The location of collecting and monitoring stations and a quarterly comparison of the results of routine measurements are included. NSA

N72-23405# Danish Atomic Energy Commission, Risoe. Research Establishment.

ENVIRONMENTAL RADIOACTIVITY IN GREENLAND IN 1970

A. Aarkrog and J. Lippert Jul. 1971 18 p refs
(RISO-247) Avail: AEC Depository Libraries

Measurements of fall-out radioactivity in Greenland in 1970 are reported. Strontium-90 (and Cs-137 in most instances)was determined in samples of precipitation, sea water, vegetation, animals, and drinking water. Estimates of the mean contents of Sr-90 and Cs-137 in the human diet in Greenland in 1970 are given. Author (NSA)

N72-23406# Los Alamos Scientific Lab., N.Mex.

PRELIMINARY LIGHTNING HAZARD STUDY

L. W. Miller Jan. 1972 8 p refs
(Contract W-7405-eng-36)
(LA-4866) Avail: NTIS

The probability of a lightning stroke to a simple but reasonable model for an underground nuclear test setup is calculated. The consequences of such a lightning stroke are also calculated so far as possible. It is concluded that pulses of amplitudes in the range of a few hundred volts to 15 kilovolts can be induced across down-hole loads. The probability of a 15 kilovolt pulse is estimated to be about 2 times 10 0.000001 per thunderstorm day. Pulses of amplitude less than 1.5 kilovolts are more than 100 times as probable as this and thus constitute the main effect to be expected due to thunderstorms in the vicinity of an underground weapon testing operation. Author (NSA)

N72-23407# National Oceanic and Atmospheric Administration, Rockville, Md. Environmental Research Labs.

ALEUTIAN SEISMIC PROGRAM. SEISMOLOGICAL

BULLETIN, MARCH 1971
Jan. 1972 73 p
(Contract AT(29-2)-746)
(CGS-746-118) Avail: NTIS HC $5.75

Tabulated preliminary data acquired during March 1971 from an Aleutian network of seismic stations are presented in order to facilitate current studies of earthquake occurrence in the Aleutian Islands. Each table includes information on: date; station; phase; time of arrival of phase; ground motion amplitude; period of phase; station magnitude; great circle distance to event; station-to-epicenter azimuth; phase travel time residual; and descriptive remarks. Six maps are presented covering the Aleutian Islands from the Near Islands to Unimak Island on which are plotted Aleutian earthquakes which were located during the month by the Aleutian seismic network and by a world network of seismological stations. NSA

N72-23408# Los Alamos Scientific Lab., N.Mex.
BALL LIGHTNING: A STATUS SUMMARY TO NOVEMBER 1971
J. L. Tuck Dec. 1971 3 p
(Contract W-7405-eng-36)
(LA-4847) Avail: NTIS HC $3.00

Switch opening arcs at currents of up to 100,000 amperes from a large submarine storage battery (50 to 600 V) gave indecisive results. Higher-voltage (approximately 10-kV) slowed-down condenser discharges were similarly indecisive, but had encouraging afterglows. Conjectures are made that: (1) The ball lightning luminosity comes from a chemiluminescent reaction preceded by a chemi-ionization. The ball lightning coherence is a consequence of a weak surface force in a cold plasma containing positive ion-negative ion dipoles. Author (NSA)

N72-23409# Entwicklungsring Nord, Bremen (West Germany).
ON EARTH RESOURCES SATELLITE PROJECTS [UEBERLEGUNGEN ZU ERDWISSENSCHAFTLICHEN SATELLITENPROJEKTEN]
H. Krueger Cologne DGLR 1971 15 p In GERMAN
Presented at the 4th DGLR Ann. Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971 Sponsored by Bundesmin. fuer Bildung und Wiss. Prepared jointly with Dornier-Werke and Standard-Electrik Lorenz
(DGLR-Paper-71-051) Avail: NTIS HC $3.00

An approach to a German earth resources satellite is presented. This would include both a meteorological and a geological mission. Two problems are emphasized: (1) the development of a multispectral line-scanner giving good resolution over an area of 100 square kilometers from an altitude of 900 kilometers, and (2) the required data handling transmission capacity and ground based data stations. The general characteristics of the satellite are discussed, and it was found that a slightly modified version of the ESRO TD-1 satellite would be suitable. Author (ESRO)

N72-23410# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Translation Section.
THE OUTER GRAVITATIONAL FIELD OF THE EARTH AND THE FUNDAMENTAL CONSTANTS RELATED TO IT
I. Zhongolovich Sep. 1971 197 p refs Transl. into ENGLISH from Tr. Akad. Nauk SSSR, Inst. Teor. Astron. (USSR), v. 3
(AD-733840; ACIC-TC-1718) Avail: NTIS CSCL 08/5

The revision and improvement of the systems of fundamental astronomic constants poses a number of problems. These concern not only the refinement of numerical values of individual constants, but also the general principles of the system construction as a whole. The study is devoted to that part of this general problem which utilizes the outer gravity field of the earth as factual material. The available material is far from being complete, but has made it possible to arrive at a number of important conclusions. These conclusions are directly related to the values of some astronomic constants and can be taken into consideration in the development of the final system of these constants. In addition, a general form of the earth geoid was incidentally obtained in this study, which can be used in a number of geodetic problems. Author (GRA)

N72-23411# Washington Univ., Seattle. Dept. of Oceanography.
EXTENSION OF OCEANOGRAPHIC STUDIES IN PUGET SOUND AND THE NORTHEAST PACIFIC OCEAN Final Report, Oct. 1963 - Dec. 1969
Francis A. Richards Dec. 1971 38 p refs
(Contract Nonr-477(37); NR Proj. 083-012)
(AD-735952; Ref-A71-57) Avail: NTIS CSCL 08/1

Contents: Research vessel operations; Biological oceanography; Chemical oceanography; Geological oceanography; Physical oceanography of the Arctic; Physical oceanography of inshore and coastal waters of Puget Sound and adjacent areas; Physical oceanographic studies of the North Pacific Ocean; Experimental investigations of internal waves; and Uses of statistical inference and experimental design in the collection and interpretation of oceanographic data. GRA

N72-23412# Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
TEMPERATURE AND SALINITY DISTRIBUTIONS IN VERTICAL SECTIONS ALONG THE LONGITUDINAL AXIS AND ACROSS THE ENTRANCE OF THE CHESAPEAKE BAY (APRIL 1968 TO MARCH 1969) Graphical Summary No. 5
R. C. Seitz Sep. 1971 106 p refs
(Contract N00014-67-A-0163-0006; Grant NSF GA-4506; NR Proj. 083-016)
(AD-735490; Ref-71-7) Avail: NTIS CSCL 08/10

Beginning in April, 1968, the Chesapeake Bay Institute vessel Ridgely Warfield obtained regular monthly sections of temperature and salinity across the entrance to the Chesapeake Bay and along the deep water channel for the entire length of the Bay (approximately 167 nautical miles). The data from the first twelve of these monthly surveys has been used to construct vertical sections of temperature and salinity along the longitudinal axis of the Bay and in the cross-sections at the entrance to the Bay. Each of the longitudinal sections was constructed using data which was obtained on a single day's run along the axis of the Bay, following as closely as possible the motion of the slack-before-flood point on the tidal cycle as it progressed from the entrance to the head of the Bay. This procedure yielded temperature and salinity sections having a minimal distortion from tidal effects. Author (GRA)

N72-23413# Montana State Univ., Bozeman.
THE MOUNTAIN SNOWPACK AS AN ENVIRONMENTAL INDICATOR Final Report, 1 Jul. 1967 - 31 Aug. 1971
Arlin B. Super Sep. 1971 21 p refs
(Contract DAHC04-67-C-0058)
(AD-735696; AROD-7166-3-EN) Avail: NTIS CSCL 08/6

The purpose of the research program reported upon herein was to gain an improved understanding of the interrelationships existing between the seasonal mountain snowpack and climate and terrain. The field investigations were carried out in the mountains of southwestern Montana over four winter seasons. Most of the studies were conducted in the Bridger Mountain Range near Bozeman, Montana. The investigation evolved into three main areas of emphasis: snowpack accumulation as related to terrain and meteorological factors, remote sensing of snow surface temperature by infrared radiometry, and study of some physical properties of the seasonal mountain snowpack through snowpit sampling. Author (GRA)

N72-23414# Oregon State Univ., Corvallis. Dept. of Oceanography.
HYDROGRAPHIC DATA FROM OREGON WATERS, 1970
Bruce Wyatt, Richard Tomlinson, William Gilbert, Louis Gordon, and Dennis Barstow Oct. 1971 143 p refs
(Contract N00014-67-A-0369-0007; NR Proj. 083-102)
(AD-735904; DATA-49) Avail: NTIS CSCL 08/10

Salinity, temperature, oxygen, phosphate, and nitrate observations were taken by Oregon State University of 15 hydrographic cruises in the Northeastern Pacific and one cruise in the Sea of Cortez during 1970. Alkalinity, pH and silicate were taken on special occasions. Author (GRA)

N72-23415# Teledyne Geotechnical, Garland, Tex.
OPERATION OF TONTO FOREST SEISMOLOGICAL OBSERVATORY Quarterly Report, 1 Oct. - 31 Dec. 1971
B. B. Leichliter 15 Jan. 1972 23 p
(Contract F33657-72-C-0013; ARPA Order 1714)
(AD-736941; TR-72-1) Avail: NTIS CSCL 17/10

The report describes the operation, evaluation, and improvement of the Tonto Forest Seismological Observatory (TFSO) located near Payson, Arizona, research and test functions carried out at the TFSO, and research and development tasks performed by the Garland, Texas staff using TFSO data. Author (GRA)

N72-23416# Naval Oceanographic Office, Washington, D.C. Special Publication, Nov. 1969 - Mar. 1970.
REPORT OF THE ANTARCTIC ICE OBSERVING AND FORECASTING PROGRAM, 1969
Rudolph J. Perchal Oct. 1971 128 p
(AD-737410; NOO-SP-80(69)) Avail: NTIS CSCL 08/12

The sea ice program conducted by the U. S. Naval Oceanographic Office principally in support of DEEP FREEZE 70 antarctic operations is presented. Methods of data collection and dissemination, ice forecasting, ice advisories and allied ice projects are discussed. Ice conditions observed by aerial reconnaissance in the Ross Sea and McMurdo Sound from November 1969 to February 1970 are summarized. Ice conditions interpreted from satellite data generally by 1- to 4-day periods are also presented. Author (GRA)

N72-23417# San Calixto Observatory, La Paz (Bolivia).
SPECTRAL CHARACTERISTICS OF INFRASONIC WAVES AND RELATED SEISMIC RESEARCH Final Report, 15 Sep. 1968 - 30 Sep. 1971
Ramon R. Cabre Nov. 1971 31 p refs
(Grant AF-AFOSR-1614-68; ARPA Order 846-69)
(AD-736946; AFOSR-72-0303TR; Pub-17) Avail: NTIS CSCL 08/11

The infrasonic array at Penas, La Paz, was enlarged from 4 to 7 microbarographs with an asymmetric disposition, covering an area of about 250 sq km. A digital recorder and an electronic integrator were added. French portable microbarographs were used for comparison and supplementary experiments. Acoustic and seismic data obtained were used for research at Observatorio San Calixto and at different research centers in the United States. Spectral analysis and correlations were made for relevant acoustic and seismic signals and infrasonic noise from them. The following values could be calculated mainly through computing programs, azimuth of arrival signals, incoherence of noise by coupling between solid earth and atmosphere, structure of the crust near La Paz, seismic energy liberation in the region for P and seismic waves earthquake focal mechanism. Some other aspects of seismicity were studied prospecting for earthquake prediction. Author (GRA)

N72-23418# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Translation Section.
RESULTS OF CALIBRATING GAL-P MARINE GRAVIMETERS
K. Ya. Kozyakova and M. G. Kogan Oct. 1971 15 p refs
Transl. into ENGLISH from the monograph "Apparatura i Metody Izmereniya Sily Tyazhesti na More" Moscow, 1970 p 62-67
(AD-737109; ACIC-TC-1782) Avail: NTIS CSCL 08/5

Four GAL-P gravimeters were calibrated by the tilt method with a relative error of less than 1:1000. The calibration of the same instruments at points with known gravity values in the range of 500 mgals conforms satisfactorily with the results of the tilt method. Author (GRA)

N72-23419# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Translation Section.
A GRAVIMETER WITH TWO NON-IDENTICAL ELASTIC SYSTEMS FOR OBSERVATIONS ON A MOBILE BASE
V. A. Romanyuk Nov. 1971 13 p ref Transl. into ENGLISH from the monograph "Apparatura i Metody Izmereniya Sily Tyazhesti na More" Moscow, 1970 p 35-40
(AD-737105; ACIC-TC-1778) Avail: NTIS CSCL 08/5

For the measurement of gravity acceleration from a mobile base, a gravimeter is proposed containing two non-identical elastic systems in which the reading of sum and difference pendulums, formed from readings of the pendulums of the elastic systems, are continuously recorded. An equation of the sum and difference pendulums is composed and a formula for correcting the observations of this gravimeter is obtained. Author (GRA)

N72-23420# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
A SPECTRUM OF NEW EXPERIMENTS TO INVESTIGATE ALKALI METAL CHEMISTRY IN THE E REGION Interim Report
J. B. Kumer Jun. 1971 30 p refs
(Contract F30602-71-C-0029; ARPA Order 1649)
(AD-737103; LMSC/D246550; RADC-TR-71-293) Avail: NTIS CSCL 04/1

The report discusses in general the chemistry of alkali metals in the upper atmosphere and the relationship between the E Region metal chemistry and alkali metal chemistry. A discussion on the merit of performing various experiments to investigate E Region metal (alkali metals and metal ions) chemistry is presented. Author (GRA)

N72-23421# Thiokol Chemical Corp., Ogden, Utah. Astro-Met Plant.
SECEDE 2 CHEMICAL PAYLOADS
George C. Alford and Ray N. Bybee 15 Jun. 1971 31 p
(Contract F30602-69-C-0030; ARPA Order 1057; Proj. Secede)
(AD-737094; RADC-TR-71-232) Avail: NTIS CSCL 04/1

For the SECEDE II operation, six barium vapor release payloads were successfully launched on rocket vehicles during the months of January and February, 1971, at Eglin Air Force Base, Florida. The SECEDE II payload matrix included barium vapor releases based on several chemical thermite weights including five each 48-kg releases, three each 1-kg releases, one 320-kg release, and one 16-kg release. With the exception of the 1-kg releases, all releases were made by simultaneous ignition of a number of canisters each containing 16-kg of thermite. Altitude effects were studied by making 48-kg releases at 150, 185, and 250 km, with 185 km as the primary release attitude. Barium vapor was produced by the exothermic reaction of a pressed mixture of barium metal chips and cupric oxide powder. The mixture ratio was 2.5 moles of barium per mole of cupric oxide with an addition of 1.8 percent by weight barium azide. Author (GRA)

N72-23422# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SEISMIC DISCRIMINATION Semiannual Technical Summary Report, 1 Jul. - 31 Dec. 1971
David Davies 31 Dec. 1971 76 p refs
(Contract F19628-70-C-0230; ARPA Order 512)
(AD-737092; ESD-TR-71-325) Avail: NTIS CSCL 17/10

New short-period data on source functions both of explosions and earthquakes are reported. Studies of wave propagation in inhomogeneous regions of the earth are described. First results from NORSAR are presented. Long-period noise and signal observations have been made, and some idea of NORSAR's discriminative capability is emerging. Network approaches to discrimination are being expanded. Major improvements in P-wave detection capability are in sight, with joint array and network analysis. New programs are being applied to the rapid acquisition of library information on seismic events. An increasing use of LASA for other geophysics projects is apparent. Author (GRA)

N72-23423# Naval Research Lab., Washington, D.C.
NONLINEAR ENERGY TRANSFER IN GRAVITY CAPILLARY WAVE SPECTRA Interim Report
Gasper R. Valenzuela 30 Dec. 1971 17 p refs
(NRL Proj. R02-37)
(AD-737189; NRL-7355) Avail: NTIS CSCL 08/3

The energy flux in gravity-capillary wave spectra has been obtained using Hasselmann (1962) perturbation analysis for a homogeneous Gaussian sea. Viscous dissipation has not been included in order to simplify the analysis. As expected the exchange of energy is a second order effect, energy is transferred from two active wave components to a third passive component. The energy transfer satisfies the requirements of conservation of energy and conservation of momentum. Author (GRA)

N72-23424# Bergen Univ. (Norway). Seismological Observatory.
LONG PERIOD DISCRIMINATION RESULTS FROM KONGSBERG
Eivind Rygg 30 Jul. 1971 27 p
(Contract F61052-68-C-0019; AF Proj. 8652)
(AD-736952; AFOSR-72-0342TR; SR-8) Avail: NTIS CSCL 17/10

The effectiveness of the M sub s-m sub b discriminant at Kongsberg has been investigated by comparing recordings from a number of explosions and earthquakes. Both US and USSR explosions have been used and differences in surface wave excitation have been demonstrated. Also, various kinds of long period spectral ratios have been calculated and compared for three different stations, Kongsberg, Kirkenes and Kings Bay. Author (GRA)

N72-23425# Bergen Univ. (Norway). Seismological Observatory.
THE DISPERSIVE EFFECT OF A MEDIUM EXPRESSED AS A CONVOLUTIONAL FILTER
Eivind Rygg 30 Jun. 1971 32 p refs
(Contract F61052-68-C-0019; AF Proj. 8652)
(AD-736956; AFOSR-72-0341TR; SR-7) Avail: NTIS CSCL 08/11

The dispersive filter function of the earth between two stations has been developed using the bandlimited spectra of the long period recordings. Different ways of applications are suggested. Experiments made with both Love and Rayleigh waves indicate that long period beamforming can be successfully performed provided the single sensor outputs are modified by filters correcting for the dispersion suffered within the array. Consequently a need for mapping the interiors of (large) arrays in terms of filters like the one mentioned, results. It is also suggested, without further experiments that the path effects between two epicenters can be studied along the same line. Author (GRA)

N72-23426# Massachusetts Inst. of Tech., Cambridge. Dept. of Meteorology.
A SIMILARITY SOLUTION FOR SLOW VISCOUS FLOW DOWN AN INCLINED PLANE
Peter C. Smith Jan. 1972 38 p refs
(Contract N00014-67-A-0204-0048; NSF GA-20616)
(AD-737399; GFD-71-1) Avail: NTIS CSCL 08/3

A similarity solution is found for the distribution of layer thickness in the slow flow of a three-dimensional, thin, viscous jet down an inclined plane. In the context of a formal asymptotic expansion in inverse powers of x, the distance downstream from the source, the solution is recognized as the zeroth-order asymptotic limit. Making use of physical arguments to exclude certain complementary functions, the solution of the first-order problem is found to be a polynomial of fourth degree. A simple experiment confirms the major features of the similarity solution. Deviations of the layer thickness measurements from the parabolic profile follow the trend predicted by the first-order corrections in the portion of flow near the edge, whereas systematically high values in the central region are explained qualitatively in terms of waves at the free surface. Author (GRA)

N72-23427# Weather Wing (4th), Ent AFB, Colo.
AN OPERATIONAL APPROACH TO FORECASTING POLAR CAP ABSORPTION (PCA) EVENTS
George J. Krause Dec. 1971 57 p refs
(AD-737355; Rept-4WW-TM-71-10) Avail: NTIS HC $5.00 CSCL 04/1

One aspect of the Aerospace Environmental Support Center (AESC) support involves the effect of solar proton events upon transpolar high frequency (HF) radio propagation. This study addresses the problem of predicting the occurrence of Polar Cap Absorption (PCA) events resulting from solar proton enhancements near earth. Various aspects of the energetic solar flare event are reviewed and an attempt is made to assess their relative importance in arriving at a PCA forecast. Data pertinent to the flare event are considered in five general classes: radio burst data, X-ray burst data, optical data, solar region history, and the sector structure of the interplanetary magnetic field. An evaluation checklist is developed for use by the AESC forecaster. The checklist reflects the varying degrees of contributions of information in the five categories toward determining the 'Total PCA Factor.' Author (GRA)

N72-23428# Air Force Cambridge Research Labs., L. G. Hanson Field, Mass.
SCIENTIFIC RESEARCH IN GREENLAND, 1967 - 1970
S. M. Silverman 17 Sep. 1971 71 p refs
(AF Proj. 7661)
(AD-736759; AFCRL-71-0489; AFCRL-SR-123) Avail: NTIS CSCL 04/1

The AFCRL Geopole Observatory carries out a series of measurements of geophysical interest near the North Pole of the geomagnetic dipole field. The nature of these measurements, the scientific and technical background, and the status during the period 1967-1970 are described. A section presenting the data availability is also included. Author (GRA)

N72-23429# Aerospace Corp., El Segundo, Calif.
SPECTRAL VARIATIONS OF THE L ALPHA SKY: A FINAL REPORT OF OBSERVATIONS FROM OGO-6 Research Report, Jun. 1969 - Sep. 1970
Paul H. Metzer and Malcolm A. Clark 1 Mar. 1972 73 p refs
(Contract F04701-71-C-0172)
(AD-736816; TR-0172(2260-10)-4; SAMSO-TR-72-4) Avail: NTIS CSCL 04/1

Data obtained in June 1969 from OGO-6 (400 x 1100 km, inclination 82 deg) reveal a consistent pattern in the observed variations of the spectral width of Lyman alpha radiation as seen by a sky-scanning photometer equipped with a resonance filter. These data have been interpreted in terms of the diurnal variation of the exospheric hydrogen temperature showing a temperature maximum near 1800 hours local time and a dawn-to-dusk difference of 200K. Evidence is presented that indicates the major source of the observed variation is local hydrogen. An analysis based on this assumption is given. Sky maps are presented that show the apparent temperature distribution across the sky, and, from these, a region is identified that appears to be aligned with the earth's magnetotail and consistently appears as a 'hot' region. The contribution of the external UV sources is discussed. Author (GRA)

N72-23430# Aeronomy Corp., Champaign, Ill.
AERONOMIC STUDIES FOR SECEDE: SECEDE 2 ROCKET PROBE EXPERIMENT
S. A. Bowhill Jan. 1971 21 p refs
(Contract F30602-70-C-0174; ARPA Order 1057; Proj. SECEDE)
(AD-736775; RADC-TR-71-256) Avail: NTIS CSCL 04/1

In order to resolve questions as to the dynamical behavior of high-altitude barium releases, a rocket probe payload has been designed and flown involving measurements of electron and ion density, electron temperature, and electric field. Six of these rockets were prepared for firing during the SECEDE II Test Series in January 1971. Some studies have also been made of

analytical models for the electron density in a striated barium cloud, aimed at determining the effect of striation superposition on their visibility. Author (GRA)

N72-23431# Rochester Univ., N.Y.
POLARIZATION, STEEPENING AND STRIATION IN BARIUM CLOUDS Semiannual Report, 15 Mar. - 14 Sep. 1971
Albert Simon and Arthur M. Sleeper Griffiss AFB, N. Y. RADC Sep. 1971 45 p refs
(Contract F30602-70-C-0001; ARPA Order 1057; Proj. Secede)
(AD-736776; RADC-TR-71-292) Avail: NTIS CSCL 04/1

Numerical results are presented for the diffusive growth in time of a barium cloud in a highly (but not infinitely) conducting ionosphere. Polarization effects produce steepening of the backside and a thinning and indentation on the front side. A crude estimate of the time required for appreciable distortion is given. Numerical results are also given for the linearized equations of motion about an ellipsoidal Gaussian equilibrium distribution. A new numerical method yields the fastest growing eigenvalue and eigenfunction and has been pushed to 49 x 49 size grids covering the cloud. The resultant eigenfunctions (in the plane perpendicular to the B field) are concentrated in the rear of the cloud and are elongated parallel to the cloud drift velocity. Finally, it is shown that results already available in the original E x B instability paper can be used to obtain an estimate of the striation scale size and onset time. Author (GRA)

N72-23432# California Univ., Los Angeles. Plasma Physics Group.
EXTERNAL PRODUCTION AND CONTROL OF ELECTROJET IRREGULARITIES
Kenneth Lee, Predhiman Kan, and Charles F. Kennel Feb. 1972 42 p refs
(Contract N00014-69-A-0200-4023)
(AD-737227; PPG-110) Avail: NTIS CSCL 04/1

Parametric coupling of a large amplitude 'pump' wave to a natural plasma mode of the ionospheric E-layer has been analytically investigated. It is shown that the E-layer plasma mode can be either stabilized or destabilized by the parametric process. Author (GRA)

N72-23433# Naval Electronics Lab. Center, San Diego, Calif.
DIURNAL PHASE VARIATION AT 10.2 kHz
E. R. Swanson and W. R. Bradford 11 Aug. 1971 41 p refs
(NECL Proj. A104)
(AD-737212; NELC-TR-1781) Avail: NTIS CSCL 20/14

Results of an empirical investigation of the diurnal phase variation of 10.2 kHz Omega signals are presented. Particular attention is paid to path definition, including excitation regions and spatial extent. Observed behavior is explained as the response of the ionosphere to incident solar radiation after consideration of characteristic but variable time constant. Anomalous electron production at sunrise, presumably due to photodetachment, is shown to be important. Author (GRA)

N72-23434# Teledyne Geotechnical, Alexandria, Va. Seismic Data Lab.
AUTOMATIC NETWORK DETECTION Scientific Report
M. H. Wirth, R. R. Blandford, and R. H. Shumway 9 Dec. 1971 80 p refs
(Contract F33657-72-C-0009; ARPA Order 1714)
(AD-737129; SDL-285) Avail: NTIS CSCL 17/10

The theory of automatic detection at a seismic array by means of an F statistic is extended to a network of such arrays. The arrays may have equal or different expected signal-to-noise ratios. Two techniques are discussed: the composite F detector in which a vote is taken among the arrays; a multi-array F detector in which the original data from the independent arrays are combined to form one F statistic. Author (GRA)

N72-23435# Teledyne Geotechnical, Alexandria, Va. Seismic Data Lab.
A COMPARATIVE STUDY OF THE ELASTIC WAVE RADIATION FROM EARTHQUAKES AND UNDERGROUND EARTHQUAKES AND UNDERGROUND EXPLOSIONS Scientific Report
D. G. Lambert, E. A. Flinn, and C. B. Archambeau 27 Oct. 1971 103 p refs
(Contract F33657-72-C-0009; ARPA Order 1714)
(AD-737125; SDL-284) Avail: NTIS CSCL 17/10

A detailed analysis of the surface wave radiation from two underground explosions (BILBY and SHOAL) and an earthquake (near Fallon, Nevada) whose epicenter is only 60 km from SHOAL indicates that: at long periods the surface wave radiation from the earthquake can be explained by a pure quadrupole (double-couple) source, but at higher frequencies the radiation pattern shows asymmetries which suggest effects due to rupture propagation which require higher-order multipole terms in the source equivalent representation; the surface waves from the explosions can be explained by superposed monopole and quadrupole sources, with no indication of higher-order multipole terms. A principal conclusion of the study is that the anomalous radiation from explosions is due to stress relaxation around the shock-generated shatter zone and not due to earthquake triggering. Author (GRA)

N72-23436# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
IONOSPHERIC AERODYNAMICS RELATED TO SPACE VEHICLES, SPACE SHUTTLES AND SATELLITES Final Report
R. S. B. Ong 20 Feb. 1972 24 p refs
(Grant AF-AFOSR-0825-67; AF Proj. 9783)
(AD-737406; AFOSR-72-0428TR) Avail: NTIS CSCL 04/1

The report summarizes the activities and results obtained during the tenure of the Grant. The relaxation problem of the Fokker-Planck collision operator is investigated. Comparisons are made between the relaxation times of the Brownian Motion and the BGK collision operators. The AC electrical conductivity and the high-frequency electrical conductivity formulas for a fully ionized gas are derived. A new mechanism of an ionizing wave front is introduced. Its structure and propagation are studied. Criteria for instabilities are found. The effect of a small amount of collisions on the stability of ion acoustic waves, drift waves, etc. are considered. Author (GRA)

N72-23437# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Translation Section.
ESTIMATE OF THE INFLUENCE OF DISTURBING ACCELERATIONS AND TILTS ON THE READINGS OF A MARINE GYROSTABILIZED GRAVIMETER
V. S. Kutepov, G. S. Markov, and E. I. Popov Dec. 1971 28 p refs Transl. into ENGLISH from the book "App. i Metody Izmereniya Sily Tyazhesti na More" Nauka, Moscow, 1970 p 67-80
(AD-737469; ACIC-TC-1783) Avail: NTIS CSCL 08/5

A description is given for a set of apparatus used in experimental studies in several expeditions, the purpose of which was to verify the theory of marine gravimetric determinations and to obtain characteristics of the background of disturbing accelerations during observations on surface ships. The results are given of the laboratory and marine investigations of this set of apparatus. A method for computing the corrections for the influence of disturbing accelerations and tilts is described. It has been shown that for this set of apparatus the corrections for the orbital motion of the ship and for joint influence of the gyroplatform tilts and accelerations with a 10-gal amplitude of horizontal accelerations, do not exceed 2 mgal, i.e., they are located within the limits of the gravimeter's reading accuracy, and with a 50-gal amplitude of horizontal accelerations they reach 40 mgal and 10 mgal, respectively. Author (GRA)

N72-23438# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Translation Section.

INVESTIGATIONS ON THE WORKING ACCURACY OF GAL-OMPO-2

V. A. Tulin and A. A. Savchenko Feb. 1972 28 p refs Transl. into ENGLISH from "Apparatura i Metody Izmereniya Sily Tyazhesti na More" Acad. Sci. USSR, Moscow. O. Yu. Shmidt Geophys. Inst. Moscow, Nauka Publishers, 1970 p 101-114

(AD-737477; ACIC-TC-1788) Avail: NTIS CSCL 08/5

The paper presents the investigation results of an automated marine gravimeter during sailing on a surface ship and in a submarine. They revealed that the gravimeter, with a working range of 12-20 gals, has plus or minus 2.8 mgal random error (10-40 gal disturbing accelerations) for work on the surface ship, and plus or minus 2.3 mgal for work in the submarine. No systematic errors result from the vertical accelerations within the range up to 35 gal; the horizontal accelerations of the same magnitude entail a systematic error amounting to 1.5 mgal. The instrument's reading accuracy is equal to 1 mgal with 0.3 - 0.4 mgal threshold of sensitivity. The gravimeter remains insensitive to line voltage variation within the limits of plus or minus 5%. Author (GRA)

N72-23439# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Translation Section.

RUG APPARATUS FOR RECORDING ACCELERATIONS AND TILTS

E. I. Popov and V. V. Sukhodolskii Jan. 1972 18 p Transl. into ENGLISH from the book "Apparatura i Methody Izmereniya Sily Tyazhesti Na" Moscow, Nauka Publishers, 1970 p 115-121

(AD-737478; ACIC-TC-1789) Avail: NTIS CSCL 08/5

A description is presented of the construction, regulating methods and determination of basic properties of the RUG apparatus for the recording of disturbing accelerations and tilts during geophysical observations from a mobile base.

Author (GRA)

N72-23440# Technology International Corp., Bedford, Mass.

PRELIMINARY SUMMARY OF OPTICAL DATA RECORDS OBTAINED FROM 1971 SECEDE 2 BARIUM RELEASE TEST SERIES Final Technical Report, Sep. 1970 - Mar. 1971

Wallace P. Boquist Mar. 1971 48 p

(Contract F30602-71-C-0004; ARPA Order 1057; ARPA Proj. OE20)

(AD-737404; TIC-711; RADC-TR-71-215) Avail: NTIS CSCL 04/1

Extensive optical measurements were made of the Phenomenological Development and Structural Characteristics of five primary and four secondary high altitude barium releases of the 1971 ARPA Project SECEDE II Test Program. The objectives of these measurements were to gather data on the morphological development, details on ion cloud striations brightness profile vs. time of the ion cloud emissions, and the development and motion history of the ion and neutral clouds. To this end, a wide array of photographic instrumentation was deployed at six widely separated sites. The main content of this report is a compilation of data record summaries for each site and event. Also included are several selected black and white photographs of the different events. Author (GRA)

N72-23441# Scottish Marine Biological Association, Edinburgh (Scotland).

[RESEARCH IN MARINE BIOLOGY AND OCEANOGRAPHY] Annual Report, 1970 - 1971

1971 92 p refs Presented at the Ann. Gen. meeting (57th), Nov. 1971

(Contract F61052-67-C-0091)

(AD-735764) Avail: NTIS CSCL 08/1

Contents: Research vessels; Research projects (Meteorology, Hydrography, Tides, Chemistry, Bacteriology, Micro-Algae, Germ-free invertebrate, Phytoplankton ecology, Zooplankton, Hydroids, Fish, Fish biology, Fish farming, Littoral and sublittoral studies, Cirripedes, Benthos, Oysters, Mussels, Ascidians, Effects of distillery effluent). GRA

N72-23442# Air Force Weapons Lab., Holloman AFB, N.Mex. Detachment 01.

APPROXIMATIONS FOR CONVERTING GEODETIC TO CARTESIAN COORDINATES Technical Report, Sep. 1970 - Aug. 1971

Herbert R. Lotze Aug. 1971 67 p refs

(AF Proj. 140AZS)

(AD-737122; AFWL-TR-71-98) Avail: NTIS CSCL 08/5

Methods are investigated which apply to the conversion of latitude, longitude and height to Cartesian coordinates in a plane tangent to the earth's surface in connection with onboard missile targeting. The criterion for the usefullness of the method is the error in the north and east coordinate with reference to Clarke's spheroid 1866. This error is determined as a function of vector length and azimuth for the spherical earth model referenced to the mean geodetic latitude at White Sands Missile Range using a program prepared for a programmable electronic desk calculator. An approximation of geocentric latitude is used in the program. It is explained how the error inherent to the spherical earth model can be reduced applying a certain correction. An expression for computing the reference coordinates in a plane tangent to the earth spheroid is derived which requires less numerical effort than the standard procedure. Author (GRA)

N72-23443# California State Div. of Highways, Sacramento. Materials and Research Dept.

INVESTIGATION OF A LASER BEAM TECHNIQUE FOR THE DETERMINATION OF SLOPE STABILITY Final Report

Travis Smith and Marvin L. McCauley Jun. 1971 21 p refs Supported in part by DOT and Federal Highway Admin.

(PB-206664; M/R-632105) Avail: NTIS HC $3.00 CSCL 14B

Equipment and a technique for detecting vibrations in a rock cut were developed. The technique utilized a reflected laser beam to achieve the necessary amplification. Although laboratory and field tests indicate that detection of vibrations can be accomplished using the laser beam, no significant advantages over the standard electronic system were obtained. Also the vibrations detected by the laser could not be correlated with events detected by the electronic system and therefore could not be correlated directly to slope stability. Author (GRA)

N72-23444# South Dakota School of Mines and Technology, Rapid City.

A PRELIMINARY INVESTIGATION OF TERRESTRIAL AND LOW ALTITUDE AERIAL INFRARED PHOTOGRAPHY AS AN AID IN DETERMINING WATER TABLE DEPTHS AND BURIED GEOLOGICAL STRUCTURES IN THE PIERRE SHALE IN WESTERN SOUTH DAKOTA Final Report

E. R. Hoskins, D. W. Hammerquist, and P. H. Rahn Jun. 1971 70 p refs Prepared in cooperation with South Dakota Dept. of Highways

(PB-206494) Avail: NTIS HC $3.00 CSCL 08G

An investigation was carried out to identify faults and joints and water table depths in road cuts in the Pierre shale from terrestrial and low altitude aerial photographs. Over 1,200 photographs were taken during the study. Three sites on the Interstate 90 east of Rapid City received repeated monthly multispectral photographic coverage for about one year. Black and white panchromatic, natural color, and infrared color films were used. The negatives and transparencies were then enlarged and printed onto both color and black and white paper with various filters on the enlarger to attempt to enhance the data presentation. Author (GRA)

N72-23445# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.

THE MEASUREMENT OF SNOW DEPTH AND DENSITY USING A SHORT PULSED RADAR SYSTEM Final Report, Jun. - Dec. 1971

Rogers S. Vickers Dec. 1971 34 p refs
(Contract DI-14-06-D-7159-1)
(PB-206685; REC-14-06-D-71591) Avail: NTIS HC $3.00 CSCL 08L

The measurement of the thickness and water content of snow and ice layers from a remote location has been the object of much research activity over the past decade. In particular, several radar techniques have been applied to the problem with varying degrees of success. A short pulse radar system is described in this report which measures the thickness and water equivalent of snow and ice layers. Representative data from field tests of the system are included, in which it is shown that snow density and thickness can be measured to better than 10% accuracy. Author (GRA)

N72-23446# Oregon State Univ., Corvallis. Dept. of Oceanography.
COMPILATION OF REPRINTS
Tjeerd H. VanAndel, Hasong Pak, Kendall L. Carder, Lutz Hasse, and Stephen Pond Dec. 1971 72 p refs
(Contract N00014-67-A-0369-0007; NR Proj. 083-102)
(AD-736111; TR-216; Ref-71-24) Avail: NTIS CSCL 08/10

Contents: Tectonics of the Panama Basin, eastern equatorial Pacific; Mie scattering by suspended clay particles; particle size distributions in the eastern equatorial Pacific; on the relationship between geostrophic and surface wind at sea; air-sea interaction; spectra of the temperature and humidity fluctuations and of the fluxes of moisture and sensible heat in the marine boundary layer. GRA

N72-23447# Yale Univ., New Haven, Conn. Dept. of Astronomy.
ASTRONOMICAL REFRACTION: COMPUTATIONAL METHOD FOR ALL ZENITH-ANGLES
Lawrence H. Auer and E. Myles Standish, Jr. Feb. 1972 16 p refs Submitted for publication
(Contract N00014-67-A-0097-0018; Grants NSF GP-20774; NSF GP-26495; NR Proj. 044-239)
(AD-737388) Avail: NTIS CSCL 04/1

It is shown that the problem of computing astronomical refraction for any value of the zenith angle may be reduced to a simple, non-singular, numerical quadrature when the proper choice is made for the independent variable of integration. The angle between the radius vector and the light ray is such a choice. The implementation of the quadrature method is discussed in its general form and illustrated by means of an application to a piecewise polytropic atmosphere. The flexibility, simplicity and computational efficiency of the method is evident. Author (GRA)

N72-23448# Woods Hole Oceanographic Institution, Mass.
USE OF VISIBLE REGION SENSORS FOR OCEAN DATA ACQUISITION FROM SPACEBORNE AND AIRBORNE PLATFORMS Final Report
George L. Clarke and Gifford C. Ewing Dec. 1971 121 p refs
(Contract N62306-70-C-0343)
(AD-736189; WHOI-Ref-71-71) Avail: NTIS CSCL 08/10

An investigation was carried out for measuring ocean color from the air, for correlating it was the physical and biological conditions of the sea, and for interpreting the data obtained. The feasibility of distinguishing between ocean areas containing low and moderate chlorophyll concentrations from flight altitudes up to 10,000 feet is shown experimentally by means of an airborne spectrophotometer. For inter-comparison of data obtained under a wide variety of conditions, a computer system to maintain and manipulate files of airborne oceanographic data stored on magnetic tape is generated and described. Author (GRA)

N72-23449# Naval Postgraduate School, Monterey, Calif.
RESPONSE OF A WATER COLUMN TO INTERNAL WAVES OF KNOWN FREQUENCIES M.S. Thesis
William John Lounsbery Sep. 1971 61 p refs
(AD-736112) Avail: NTIS CSCL 08/3

A program is developed to ascertain the response of a frictionless water column to internal waves. Using density strata as input, the program selects ten frequencies at equal intervals within a spectrum of internal waves bounded above by the maximum Vaisala frequency and below by the inertial frequency. Ray paths within the column are plotted for these frequencies. The first ten normal modes for each frequency are computed. The first three modes are plotted. Author (GRA)

N72-23450# Naval Postgraduate School, Monterey, Calif.
A STUDY OF LIGHT ATTENUATION IN MONTEREY BAY, CALIFORNIA M.S. Thesis
Thomas Walter Crews, III Sep. 1971 145 p refs
(AD-736119) Avail: NTIS CSCL 08/10

A single ocean station was occupied for 27 hours during the Upwelling Period in Monterey Bay, California, to study light attenuation and its relation to other standard oceanographic parameters. Comparisons were made with earlier local studies. It was found that the vertical distributions of the oceanographic parameters studied are dependent on both the seasonal conditions and geographical location. The largest concentration of suspended particles was found in the upper 10-15 m of the water column where most of the light attenuation occurred. The largest attenuation gradient was found in the pycnocline. A linear relation was suggested between the attenuation coefficient and the cumulative projected cross-sectional area of the particles. Apparent relations were found between light attenuation and temperature, salinity, density, and oxygen and phosphate concentrations. Author (GRA)

N72-23451# Delaware Univ., Newark. Coll. of Marine Studies.
A GUIDE TO THE GEOLOGY OF DELAWARE'S COASTAL ENVIRONMENTS
John C. Kraft Oct. 1971 224 p refs Presented at Geol. Soc. of Am. Ann. Meeting and Field Trip, 30 Oct. - 3 Nov. 1971
(Contract N00014-69-A-0407)
(AD-736036; CMS-2GL039; TR-1) Avail: NTIS CSCL 08/7

The low-lying Delaware coast includes the highly varied geomorphic elements of a major estuary; highlands undergoing erosion; spits; dunes, marshes; and a lagoon-barrier shoreline. Vertical sediment sequences and geomorphic patterns as interpreted in this study should form useful models in deciphering paleogeography an sedimentary processes of coastal change. The three major elements of coastal change identified include: (1) the relative rise in sea level (now proceeding at a rate of approximately 1/2 foot per century), (2) coastal erosion and deposition processes, and (3) the resultant sequences of sedimentary lithosomes which reveal the past history of coastal change. The physical elements of the coastal geology are illustrated with photographs comparing details on the surface and from the air. Many diagrams and cross sections interpret and project and structural information obtained in field surveys. Author (GRA)

N72-23452# Woods Hole Oceanographic Institution, Mass.
RESPONSE CHARACTERISTICS OF THE NEUTRALLY BUOYANT FLOAT
Arthur D. Voorhis Dec. 1971 78 p refs
(Contract N00014-66-C-0241; NR083004)
(AD-736188; WHOI-Ref-71-73) Avail: NTIS CSCL 08/3

The response characteristics of the neutral buoyant vertical current meter are discussed primarily from a theoretical point of view. Computations are presented to illustrate the useful range and limitations of present instruments. Three aspects of the response are considered separately: rotational, vertical, and tilting due to vertical shear. The rotational response at low frequencies is poor only for very weak vertical currents due to viscous drag. At high frequencies the response is uniformly limited by the moment of inertia of the instrument. The vertical response is best in neutrally stable water. In highly stratified water, on the other hand, the response deteriorates for all

frequencies because of the small relative flow past the instrument. In all cases it is limited at high frequencies because of instrument inertia. Author (GRA)

N72-23453# National Technical Univ., Athens (Greece). Photogrammetric Lab.
EFFECT OF SYSTEMATIC ERRORS ON THE VARIANCE OF UNIT WEIGHT OF TRIANGULATION NETWORKS Final Report
John Badekas Nov. 1971 20 p refs
(Contract DAJA37-70-C-0862; DA Proj. 2M0-61102-B-52B)
(AD-736411) Avail: NTIS CSCL 08/5

In the first year of this project it is found that the effect of deflections of the vertical on the misclosures of a triangle can be significant, but in some cases these deflections do not affect the misclosures. The effects of the same deflections on the site conditions has been calculated for some cases but general patterns could not be recognized and firm conclusions drawn. It is expected that they will be clarified as the research continues. Author (GRA)

N72-23454# Little (Arthur D.), Inc., Cambridge, Mass.
TILTMETER INSTRUMENTATION FOR DEEP HOLE OPERATION Semiannual Report, 15 Jun. - 15 Dec. 1971
Ivan Simon 15 Dec. 1971 18 p refs
(Contract F44620-70-C-0074; ARPA Order 1584)
(AD-736543; ADL-C-72720-SA; AFOSR-72-0272TR) Avail: NTIS CSCL 08/7

The first of the deep-hole tiltmeter systems developed under the present contract was completed and is under tests in a shallow borehole in a stable rock formation at Bedford, Massachusetts. The performance of the system was found to be on the whole satisfactory and it continues to be satisfactory after more than 3000 hours of continuous operation in the borehole. Nevertheless, a few unexpected problems were encountered during the tests. A 'tilt noise' caused by thermal convection in the water-filled borehole was found to interfere with recording at low signal levels. Apparent drift of the zero setting was observed when the downhole package was mechanically decoupled from the cable. The present data logging system, when operated at sampling rates slow enough to permit long-term unattended operation lacks the capability of recording randomly occurring events of short duration. Most of the problems have been resolved and modifications will be made in the present and forthcoming units. Author (GRA)

N72-23455# Washington Univ., Seattle. Dept. of Oceanography.
CURRENT MEASUREMENTS IN PUGET SOUND AND ADJACENT WATERS, JULY 1948 - NOVEMBER 1955
Eugene E. Collias, comp. Oct. 1971 152 p refs
(Contract N00014-67-A-0103-0014; Nonr-477(10); NR Proj. 083-012)
(AD-734688; Ref-M71-64; TR-271) Avail: NTIS CSCL 08/3

A tabulation is presented of current measurements made at various locations in Puget Sound and the San Juan Islands from July 1948 through November 1955. Measurements were made by continuously indicating meters, but only values at selected times are reported. Author (GRA)

N72-23456# RAND Corp., Santa Monica, Calif.
GEOSCIENCES BULLETIN, SERIES A, VOLUME 2, NUMBERS 1-7, JANUARY - JULY 1971
C. Shishkevish Jul. 1971 221 p refs
(Contract DAHC15-67-C-0141; ARPA Order 18921)
(AD-731659; RM-6300-5-ARPA) Avail: NTIS CSCL 08/11

A 7-month issue of the Rand periodical is presented, consisting of abstracts, annotations, translations, news items, and analytical surveys of current Soviet and East European open scientific literature relevant to seismology and detection of underground nuclear explosions. Particular emphasis is given to Soviet research on shock waves during the last two years. This issue includes a review of the effectiveness of seismic discriminants for underground nuclear explosions. An appendix provides a list of references used in this issue of the Bulletin. Author (GRA)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N72-23457* American Air Filter Co., Inc., St. Louis, Mo.
GAS FILTER MOUNTING STRUCTURE Patent
Wilson A. Welch and William A. Medcalf, inventors (to NASA) Issued 21 Mar. 1972 5 p filed 21 Jan. 1969 Sponsored by NASA
(NASA-Case-MSC-12297; US-Patent-3,650,095; US-Patent-Appl-SN-792623; US-Patent-Class-55-493; US-Patent-Class-55-498; US-Patent-Class-55-502; US-Patent-Class-55-521) Avail: US Patent Office CSCL 14B

An improved filter apparatus for gas separation and a useful arrangement of a ring-type filter structure combined with an annular passage of a plenum chamber are discussed. The apparatus overcomes the disadvantages of previous equipment by providing a straightforward and economical device which allows quick installation and removal with a minimum of leakage and a maximum of access for installation and removal. The device also provides accurate alignment of the filter cell on its support frame and requires a minimum application of edge sealant materials. P.N.F.

N72-23458*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LUNAR SURFACE MAGNETOMETER DESIGN REVIEW
23 Mar. 1970 132 p
(NASA-TM-X-67676) Avail: NTIS HC $8.75 CSCL 14B

Design and fabrication parameters of a lunar surface magnetometer are discussed. Drawings and requirements for mechanical design, electronic packaging design, thermal design, quality assurance and systems testing are included. G.G.

N72-23459*# Perkin-Elmer Corp., Pomona, Calif. Aerospace Div.
ATMOSPHERIC CONTAMINANT SENSOR, BOOK 1 Final Report
Burton W. Scott and J. H. Stuart Apr. 1972 15 p
(Contract NAS9-12066)
(NASA-CR-115558; SPO-30249-Bk-1) Avail: NTIS HC $3.00 CSCL 14B

Design and fabrication of a mass spectrometer system for use as an atmospheric monitor by submarine is reported. The performance design goals are presented. The operation of the system is essentially automatic, providing continuous display of the partial pressures of the principal atmospheric constituents and a pushbutton update display of two freon trace contaminants. The freon update cycle takes 15 or 30 seconds, depending on which are measured. Trouble free, long term, reliable operation, and ease of maintenance are the primary system requirements. The requirement of the freon detection with high sensitivity and high resolution made redesign of the overall analyzer housing and magnet necessary. Author

N72-23460*# Perkin-Elmer Corp., Pomona, Calif.
ATMOSPHERIC CONTAMINANT SENSOR. BOOK 2: APPENDICES Final Report
Burton W. Scott and J. H. Stuart Apr. 1972 166 p
(Contract NAS9-12066)
(NASA-CR-115559; SPO-30249-Bk-2) Avail: NTIS HC $10.50

CSCL 14B

Appendices containing equipment specifications and performance test data of the atmospheric contaminant sensor for submarines are presented. G.G.

N72-23461*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A 1.5 TO 38 KeV X-RAY EXPERIMENT SYSTEM FOR HIGH ALTITUDE SOUNDING ROCKETS

F. B. Birsa, C. A. Glasser, and M. M. Ziegler Mar. 1972 95 p ref

(NASA-TM-X-65868; X-661-72-80) Avail: NTIS HC $6.75 CSCL 20F

The X-ray spectroscopy experiment to be flown on Aerobee Flight 13.009 is described. A brief description of the detector system is given along with a description of the electronic equipment. Author

N72-23462*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LOW g ACCELEROMETER TESTING

Miller S. Vaughan and Miller S. Vaughan (Sperry Rand Corp.) 13 Jan. 1972 48 p refs

(NASA-TM-X-64655) Avail: NTIS HC $4.50 CSCL 14B

Eight different types of low-g accelerometer tests are covered on the Bell miniature electrostatically suspended accelerometer (MESA) which is known to be sensistive to less than 10 to the minus 7th power earth's gravity. These tests include a mass attracting scheme, Leitz dividing head, Wild theodolite, precision gage blocks, precision tiltmeters, Hilger Watts autocollimator, Razdow Mark 2 autocollimator, and laser interferometer measuring system. Each test is described and a comparison of the results is presented. The output of the MESA was as linear and consistent as any of the available devices were capable of measuring. Although the extent of agreement varied with the test equipment used, it can only be concluded that the indicated errors were attributable to the test equipment coupled with the environmental conditions. Author

N72-23463# Lockheed Missiles and Space Co., Palo Alto, Calif.

NOMOGRAM TO DETERMINE THE OPTIMAL VALUES OF A GROUND-BASED GYROCOMPASS PARAMETERS ASSURING MINIMUM OF THE UNDAMPED VIBRATIONS PERIOD

Iu. I. Ushanov [1972] 2 p ref Transl. into ENGLISH form Izv. Vyssh. Ucheb. Zaved., Priborostr. Leningrad), no. 11, 1971 p 79-81

Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A numerical analysis of the performance of gyrocompasses is presented. A nomogram is developed to determine the optimal values of ground-based gyrocompass parameters assuring minimum of the period of undamped precessional vibrations. A foundation is presented for the construction of nomograms and an illustration explaining its use is provided. Numerical relationships and mathematical models are included to support the theoretical considerations. Author

N72-23464# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON THE THEORY OF A SEMI-GYROCOMPASS ON A MOVING BASE

L. A. Motylkov, V. I. Kanishchev, and A. M. Belskii. [1972] 4 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), no. 11, 1971 p 82-85

Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The precessional motion of a semi-gyrocompass when the instrument is mounted on a moving base was investigated. Peculiarities noted in the precession of the instrument due to the nature of the base displacement are discussed. Author

N72-23465*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OPTIMIZATION OF MULTIMAGNETOMETER SYSTEMS ON A SPACECRAFT

F. M. Neubauer Apr. 1972 29 p refs Submitted for publication

(NASA-TM-X-65879; X-692-72-104) Avail: NTIS HC $3.50 CSCL 14B

Magnetometers on a radial boom may be employed to determine the first N-1 multipole contributions to the spacecraft field and improve the total accuracy of a magnetic field experiment. The total error for systems of one to four magnetometers is investigated. The optimal magnetometer locations, for which the total error is a minimum, are found for given boom-length, instrument errors and magnetic field models characteristic for spacecraft with only a restricted or ineffective magnetic cleanliness program. Author

N72-23466# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.

STANDARD REFERENCE MATERIALS: THERMOELECTRIC VOLTAGE OF SILVER-28 ATOMIC PERCENT GOLD THERMOCOUPLE WIRE, SRM 733, VERSUS COMMON THERMOCOUPLE MATERIALS (BETWEEN LIQUID HELIUM AND ICE FIXED POINTS)

L. L. Sparks and J. G. Hust Apr. 1972 34 p refs

(NBS-SP-260-34) Avail: SOD $0.40 as C 13.10:260-34

Industry wide standardization to thermocouple wire depends, in part, on the ability to thermoelectrically compare commercial wires with a Standard Reference Material (SRM). The alloy Ag - 28 at % Au, SRM 733, meets the requirements of a thermoelectric reference material, particularly in the temperature range of liquid helium and liquid hydrogen where Pt-67 is not adequate. Thermoelectric voltage comparisons are reported for SRM 733 versus common thermocouple materials between liquid helium and ice fixed points. Detailed standard reference data based on these common materials are given in NBS Monograph 124. The comparisons were made in a thermocouple comparator which was designed to be a permanent holder of three SRM 733 wires; the comparator allows tests to be made without handling the standard wires. Details of the construction, testing, and analysis of the comparators are given. Author

N72-23467*# National Aeronautics and Space Administration, Washington, D.C.

TRANSDUCER APPLICATIONS, A COMPILATION

Technology utilization

1972 37 p

(NASA-SP-5954(01)) Avail: NTIS HC $1.00 CSCL 14B

The characteristics and applications of transducers are discussed. Subjects presented are: (1) thermal measurements, (2) liquid level and fluid flow measurements, (3) pressure transducers, (4) stress-strain measurements, (5) acceleration and velocity measurements, (6) displacement and angular rotation, and (7) transducer test and calibration methods. P.N.F.

N72-23468# Joint Publications Research Service, Arlington, Va.

DETERMINATION OF DEFORMATION AND RIGIDITY OF THE GYROSCOPE UNIVERSAL JOINT SUSPENSION FRAMES

O. I. Ivanov 25 Apr. 1972 7 p refs Transl. into ENGLISH from Priborostroenie (Leningrad), v. 15, no. 1, 1972 p 94-97

(JPRS-55793) Avail: NTIS HC $3.00

Elastic deformations of the universal joint suspension were studied in the construction of gyro instruments, since they affect the gyroscope movement. One of the basic elastic elements of the universal joint suspension is its frames. Three types of frames are discussed: rectangular, circular, and elliptical. It is assumed that the frames are made of constant cross section rods, the weight of which is not considered. It was shown that the frames whose supports are designed with a temperature decoupling cannot be made of equal rigidity. Author

N72-23469# Heidelberg Univ. (West Germany). Physikalisches Inst.

INVESTIGATIONS OF MAGNETOSTRICTIVE DELAY LINES FOR SPARK CHAMBER READOUT

E. Mittag Oct. 1971 86 p refs In GERMAN; ENGLISH summary

(BMBW-FBK-71-14) Avail: AEC Depository Libraries

A systematic description of the properties of magnetostrictive delay lines for spark chamber readout is given. Longitudinal sound waves in demagnetized round wires produce a readout voltage which is approximately proportional to the second derivative of the chamber current. The damping is larger in magnetized round wires, also the signal is distorted over larger distances. In round wires torsional waves can be used too, having no dispersion and allowing larger wire diameters. No pulse distortion is observed for longitudinal waves in magnetized wire ribbons. Magnetostrictive delay lines are also suitable for longtime signal storage. Author (NSA)

N72-23470# International Atomic Energy Agency, Vienna (Austria).

HANDBOOK ON CALIBRATION OF RADIATION PROTECTION MONITORING INSTRUMENTS

Nov. 1971 95 p refs

(STI/DOC-10/133) Avail: Intern. Atomic Energy Agency, Vienna: $3.00

Topics include requirements of a calibration laboratory and the techniques to be used, calibration facilities, errors and quality control, and instrument maintenance and repair. Presented in the appendixes is a list of primary standard laboratories, a USSR State Standard for checking instruments for monitoring gamma exposures at 0.2 to 1.5 MeV, and a description of a typical laboratory building and staff. NSA

N72-23471# Illinois Univ., Urbana. Dept. of Computer Science.

COEFFICIENT GENERATOR AND CURSOR FOR THE STEREOMATRIX 3-D DISPLAY SYSTEM Ph.D. Thesis

Richard Thien-Ren Cheng Oct. 1971 98 p refs

(Contract AT(11-1)-1469)

(COO-1469-195; UIUCDCS-R-71-484) Avail: NTIS

The design, implementation and operation are described for the coefficient generator and cursor for a three-dimensional on-line laser display system called stereomatrix. Stereomatrix displays a computer-generated 3-D line drawing on a 3-by-4 foot rear projection screen. The 3-D effect is achieved by the generation of a stereoscopic pair of points corresponding to each point on the line being displayed. The coefficient generator generates a set of coefficients to rotate, scale, or translate the figure about the x, y, and/or z axis. The coefficients are generated by applying an orthogonal or a linear transformation matrix to the original coefficient matrix (a unit matrix if it has not been operated). The cursor is a lighted spot on the screen which can be moved around in the viewing space by a 3-D joystick. It can be used to point at a point of interest, to draw a figure, and to relate the computer space coordinate and the viewing space coordinate precisely, implementing a coefficient matrix inverse transformer. The cursor is first operated by inverse coefficients and then by the coefficients before being displayed. Author

N72-23472# National Reactor Testing Station, Idaho Falls, Idaho.

TRANSIENT RESPONSE OF TRANSDUCERS: DEFINITIONS AND CHARACTERISTICS

J. B. Colson and R. H. Meservey Nov. 1971 33 p refs

(Contract AT(10-1)-1375)

(ANCR-1037) Avail: NTIS

Clarification is provided for definitions of many terms used in transducer instrumentation technology. An alphabetical listing of common terms and their definitions is presented. In addition, a discussion of the response of first- and second-order systems to step and ramp inputs is included. It is shown that a single term does not adequately define the transient response of a transducer system. Author

N72-23473# Iowa State Univ. of Science and Technology, Ames.

HIGH FREQUENCY NUCLEAR MAGNETIC RESONANCE IN THULIUM INTERMETALLIC COMPOUNDS Ph.D. Thesis

William Conrad Smith Nov. 1971 177 p refs

(Contract W-7405-eng-82)

(IS-T-501) Avail: NTIS

The NMR frequency shifts of the Tm-169 nucleus in the NaCl-type intermetallic compounds TmP, TmAs, TmSb, and TmBi were measured at 4.2 deg K over a wide range of applied magnetic field strengths. The shifts for TmAs and TmBi were found to be field-independent for field strengths below 3.5 kOe, but a relatively strong field dependence was measured for TmP. In the case of TmP, measurements were extended beyond 6.5 kOe, corresponding to a resonance frequency of almost 180 MHz. The shifts were observed to increase with applied magnetic field strength. The shift value for TmBi was measured to be 79.9(2). This value of the shift for TmBi was based on the Tm-169 gyromagnetic ratio of 0.352 kHz/Oe. The peak-to-peak line width of the Tm-169 resonance derivative was directly proportional to the applied field, with the proportionality accounted for by the bulk demagnetizing field within a magnetic powder sample, except in the case of TmBi. Author (NSA)

N72-23474# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.

PULSED EDDY CURRENT DEVELOPMENT WITH APPLICATIONS TO THE NONDESTRUCTIVE EVALUATION OF MATERIALS

J. E. Coulter 2 Feb. 1972 27 p refs

(Contract W-7405-eng-26)

(Y-1820) Avail: NTIS HC $3.50

A pulsed eddy-current system has been developed primarily for use in the testing of welds in several different materials. However, to attain a better understanding of the nature of the pulsed-current field and the parameters which affect pulse shape, a theoretical analysis was made for the case of a finite pulsed magnetic field applied at the surface of a conductor in which it was shown that the pulse width should be proportional to the conductivity, thickness, and permeability of the conductor. Experimental data were taken to support these theoretical conclusions, and additional data are presented to demonstrate the application of the pulsed system to the nondestructive testing of materials. Particular emphasis is placed upon the use of sampling techniques which enable one to choose the point on the pulse which contains the most information concerning the variable to be tested. A lift-off compensating servo-system is described which makes use of one of these sampling methods to provide the pulsed system with a continuous scanning capability. Author

N72-23475# Sandia Labs., Albuquerque, N.Mex.

USE OF PHOTOCHROMIC GLASSES AND FILMS IN OPTICAL PROCESSING APPLICATIONS

K. R. Hessel Dec. 1971 14 p refs Presented at the Optical Soc. of Am. Meeting, Ottawa, 5 Oct. 1971 Sponsored by AEC

(SC-DR-710829; Conf-711039-1) Avail: NTIS HC $3.00

Certain photochromic glasses and films (Corning X190 SJE glass sample and Vari-Light VL 316A film) on transparent substrates can be utilized as storage materials or input mediums for optical processing applications. No development is required and the material is reusable. With a 15-milliwatt laser, holograms can be made and read out in less than 1 second and about 10 seconds is routine. Techniques for making Fourier transform holograms by predarkening the photochromic and by using a combined red and ultraviolet reference beam are described. The variation in available read out time with the exposure time and type of reference beam is discussed. Photochromics permit rapid evaluation of system performance during feasibility studies. Author

N72-23476# Sandia Labs., Albuquerque, N.Mex.

DIFFRACTOMETER FOR LARGE SPECIMENS

E. L. Jacobs and K. D. Nokes Jan. 1972 14 p Sponsored by

AEC
(SC-DR-710747) Avail: NTIS HC $3.00

To provide a system which would be feasible for use in a nondestructive test lab, a prototype large sample diffractometer was constructed. Calibration samples with known spacings were used to obtain reference peaks and then locate unknown peaks by extrapolation. The system described was established chiefly for use with carbon/carbon nose cones, and the discussion relates mainly to this application. However, it may be used equally well with other crystalline materials. Author

N72-23477# Sandia Labs., Albuquerque, N.Mex.
MODEL HDA-70 STRAIN-GAGE SYSTEM
H. D. Arlowe and R. D. McAvoy Jan. 1972 36 p refs Sponsored by AEC
(SC-DR-710238) Avail: NTIS HC $4.00

These 12-channel systems were built to provide an improved strain data amplifier capability, especially where high-energy electrical sources are used. The high level of magnetic- and electrostatic-induced voltages has rendered the traditional commercial amplifiers useless for measuring early strain data during flyer-plate simulation testing. Author

N72-23478# Los Alamos Scientific Lab., N.Mex.
TIME DOMAIN REFLECTOMETRY FOR STRAIN AND MANGANIN GAUGE SENSING
R. R. Fullwood 1971 9 p Presented at Underground Nucl. Test Meas. Symp., Albuquerque, N.Mex., 7 Dec. 1971 Sponsored by AEC
(LA-DC-13313; Conf-711208-1) Avail: NTIS HC $3.00

The time domain reflectometry technique was investigated for sensing the dynamic resistance of piezo-resistive gauges used for stress or strain measurements. The technique has the advantage of presenting calibration and base line information directly on the shot record by time sharing, but has the disadvantage of reducing the frequency response of the recording by about a factor of three. The TDR method also suffers from the practical problem of the production of fast, high-voltage pulses at a high repetition rate. Experimental laboratory measurements are presented. The more conventional pulsed bridge is investigated from a pulse propagation viewpoint and is found to be correct in principle, but sometimes wrong in practice. Author (NSA)

N72-23479# California Univ., Livermore. Lawrence Livermore Lab.
LINEAR DISPLACEMENT TRANSDUCER FOR SEVERE ENVIRONMENT APPLICATIONS
John W. Pruner 30 Nov. 1971 11 p refs Presented at Underground Nucl. Test Meas. Symp., Albuquerque, N.Mex, 7-9 Dec. 1971; Sponsored by Defense Nucl. Agency and Sandia Labs. Submitted for publication Sponsored by AEC
(UCRL-73477) Avail: NTIS

A linear displacement transducer has been developed to provide both active and passive impulsive measurements of small material samples exposed to nuclear radiation. The transducer is designed to operate in an underground nuclear blast environment where sample velocities to 200 in/sec and high accelerations are encountered. Actively, the transducer provides a pulse-amplitude-modulated analog output signal for recording of linear displacement with time data. Crushable honeycomb is utilized to provide a passive measure of the kinetic energy of a moving mass. Secondary honeycomb crush due to shock loading of the transducer support structure is limited by the application of a unique self-locking design feature. Design innovations to facilitate shipping, handling, installation and field calibration are incorporated into the transducer configuration. Transducer performance is evaluated under controlled laboratory conditions. Author (NSA)

N72-23480# Oak Ridge Gaseous Diffusion Plant, Tenn.
MASS SPECTROMETER WITH DUAL APERTURE COLLECTION OF URANIUM ISOTOPES
C. Sulfridge and A. Langdon 29 Dec. 1971 11 p refs
(Contract W-7405-eng-26)
(K-1880) Avail: NTIS HC $3.00

A mass spectrometer with a dual-aperture collector assembly is described which simultaneously resolves two uranium isotopes from all others and permits the measurement of the ratio of two specific isotopes. Precise relative measurements of uranium isotopes were made to assist in the performance analysis of a molten salt reactor. Author (NSA)

N72-23481# California Univ., Berkeley. Lawrence Radiation Lab.
MODIFIED AND COMPLETED 1 PI CLINOSTAT-IRRADIATION SYSTEM
Ira Lee Silver Oct. 1971 25 p
(Contract W-7405-eng-48)
(LBL-511) Avail: NTIS HC $3.25

A clinostat-irradiator complex has been designed and built at the Lawrence Berkeley Laboratory. The purpose of these instruments is to study radiation effects on small organisms while they exist under various degrees of gravity compensation. The integrated, experimental system is described. Author (NSA)

N72-23482# Hawker Siddeley Dynamics, Ltd., Stevenage (England).
CONTROL MOMENT GYRO APPLICATIONS TO SPACECRAFT ATTITUDE CONTROL AND STABILIZATION
L. Flook Paris ESRO Aug. 1970 225 p refs Prepared for ESRO
(Contract ESTEC-802-69)
(ESRO-CR-23) Avail: NTIS HC $13.25

Control moment gyroscope configurations for satellite three axis stabilization, are assessed by examination of the system equations of motion. Author (ESRO)

N72-23483# British Aircraft Corp. (Operating) Ltd., Bristol (England).
SOLID-BACKED THERMOPILES Technology Development. Final Report
L. Callard, E. Baldwin, and J. Dalgliesh Paris ESRO Jul. 1971 195 p refs Prepared for ESRO
(Contract ESTEC-831-69)
(ESRO-CR-41) Avail: NTIS HC $11.75

The principles of thermocouples and thermopiles are described and existing devices reviewed. The work is divided into three parts: (1) the selection and deposition of a suitable thermoelectric material, (2) the development of an absorbing system that is mechanically superior to gold-black, and (3) the construction and performance of thermopile models. Bismuth telluride is chosen as the thermoelectric material. The three deposition techniques for producing films of Bi_2Te_3 are described, and various approaches to improving the absorbing system are considered. Author (ESRO)

N72-23484# Institut Franco-Allemand de Recherches, St. Louis (France).
DEVELOPMENT AND TESTING OF THE 'QUAMOPOL' MASS SPECTROMETER [AUFBAU UND ERPROBUNG EINES VIERFACH-MONOPOL-MASSENSPEKTROMETERS]
F. Aulinger and H. Trinks 21 Dec. 1970 29 p refs In GERMAN
(ISL-26/70) Avail: NTIS HC $3.50

A mass spectrometer without magnetic field is described which enables the simultaneous and continuous determination of four different gas components. These gas components are in the mass range of 1 u to 44 u, in which 1 u equals 1/12 of C-12 mass. The instrument incorporates a symmetric ion source, and allows short measuring times of up to 100 microseconds; it is suitable for gas analysis in hypersonic shock tunnels. Some of the laboratory results are discussed. Author (ESRO)

N72-23485# Southwest Research Inst., San Antonio, Tex.
DESIGN OF SIMPLIFIED LOW MASS RATIO FLUTTER MODELS Final Report
Guido E. Ransleben, Jr. Nov. 1971 42 p refs
(Contract N00014-71-C-0151; SwRI Proj. 02-2988; SR0090101)
(AD-737343) Avail: NTIS CSCL 14/2

The design of hydrodynamic flutter models is a difficult compromise between adequate flexibility to ensure flutter within the relatively restricted speed range of existing facilities and adequate strength to withstand the static loading imposed by small misalignments or excitation deflections. The investigation was restricted to configurations which could be machined from a single, solid piece of material by simple sawing, drilling, or milling operations, other than the contouring of the external surfaces. Author (GRA)

N72-23486# A.Q.D. Labs., Harefield (England).
THE USE OF PAPER BASED EMULSION IN INDUSTRIAL RADIOGRAPHY
J. C. Rockley and D. A. Croft Apr. 1971 34 p refs
(AD-737332; AQD/XNDT-001158; TRC-BR-24924) Avail: NTIS CSCL 14/5

The radiographic characteristics of four types of photographic paper were investigated. It was found that a developer-incorporated printing paper, when exposed in conjunction with a fluorescent salt screen, was capable of giving radiographs of surprisingly high quality when produced at radiation energies not exceeding 200 kV. The economic advantages arising from the use of this type of radiograph in suitable applications are discussed. Author (GRA)

N72-23487# Royal Aircraft Establishment, Farnborough (England).
AN ALBEDO HORIZON SENSOR USING HYBRID CIRCUITRY
A. K. Brookman Jul. 1971 21 p
(AD-737004; RAE-TR-71153; BR26780) Avail: NTIS CSCL 22/2

Successful operation of an albedo horizon sensor using hybrid circuitry was demonstrated in the flight of Skylark SL 904. Two sensors were flown, each having an array of 16 detector elements and the vehicle roll angle was measured over a 60 degree range to an accuracy estimated to be about 0.3 degree. Details are given of the construction and operation of the sensors and suggestions made for future applications. Author (GRA)

N72-23488# Honeywell, Inc., Minneapolis, Minn. Government and Military Products Div.
CRYOGENIC MASS FLOWMETER Final Report, Jul. 1970 - Jun. 1971
Edward R. Wuori and Jerome J. Rusnak Edwards AFB, Calif. AFRPL 17 May 1971 153 p refs
(Contract F04611-70-C-0057; Honeywell Proj. 21583)
(AD-736778; Honeywell-21583-FR; AFRPL-TR-71-83) Avail: NTIS CSCL 14/2

The report covers work performed on a cryogenic linear momentum mass flowmeter. The meter consists, primarily, of an oscillating dragbody with signal conditioning electronics. The meter theory and design are covered in detail, with design and performance criteria given. Flow tests were conducted in Stoddard solvent (room temperature) and liquid hydrogen (40R), demonstrating the meter with a 10/1 density change. Author (GRA)

N72-23489# Commonwealth Scientific and Industrial Research Organization, Glen Osmond (Australia).
THE CALCULATION OF RESULTS IN ELECTRON-PROBE MICROANALYSIS
A. C. Oertel 1971 26 p
(PB-205798; Tech-Paper-9) Avail: NTIS HC $3.00 CSCL 14B

Two algorithms for the calculations of electron probe analytical results are discussed, and computer programs based on them are presented. Author (GRA)

N72-23490# ARO, Inc., Arnold Air Force Station, Tenn.
RESULTS OF WIND TUNNEL TESTS ON A FLIGHT PATH ACCELEROMETER AT MACH NUMBERS FROM 0.2 TO 3.0 Final Report, 7 Jun. - 18 Aug. 1971
James C. Uselton and T. O. Shadow AEDC Feb. 1972 26 p refs
(Contract F40600-72-C-0003; AF Proj. 6903; ARO Proj. VA0078)
(AD-736819; AEDC-TR-71-260; ARO-VKF-TR-71-187) Avail: NTIS CSCL 14/2

A program was conducted at the Arnold Engineering Development Center (AEDC) to design, fabricate, and test new full-scale angle-of-attack and sideslip vanes for the newly developed flight path accelerometer (FPA) to alleviate the dynamic stability problem of the previous vanes. The investigation was conducted in the von Karman Gas Dynamics Facility (VKF) Supersonic Wind Tunnel (A) and in the Propulsion Wind Tunnel Facility (PWT) Aerodynamic Wind Tunnel (4T). From dynamic stability tests of several vane configurations, the best performance vanes were selected and a position error calibration of Reynolds number range based on boom diameter from 160,000 to 1,140,000. The angle of attack ranged from -3 to 24 deg. The selected vanes were dynamically stable over the entire Mach number range. Author (GRA)

N72-23491# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Translation Section.
ON THE OPERATION OF A MARINE GRAVIMETER WITH A CODING ATTACHMENT
V. A. Tulin Jan. 1972 15 p refs Transl. into ENGLISH from the publ. "Apparatura i metody izmereniya sily tyazhesti na more" Moscow, Nauka, 1970 p 80-85
(AD-737474; ACIC-TC-1784) Avail: NTIS CSCL 08/5

The article discusses the performance analysis of a gravimeter with an analogue-to digital converter of its reading on a submarine. It gives a characteristic of the zero-point displacement under various transportation conditions of the instrument. The dependence of the observation random error on the duration of these conditions has been experimentally determined. It has been shown that during work on the submarine the results of the measurements are free of systematic error. The random component is equal to plus or minus 2.2 mgal, and the error of a tack amounts to about plus or minus 3.5 mgal. Author (GRA)

N72-23492# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Translation Section.
ON THE SECOND DEGREE OF FREEDOM OF THE PENDULUM IN THE ELASTIC SYSTEM OF QUARTZ GRAVIMETERS
L. A. Zhuchkov Jan. 1972 10 p Transl. into ENGLISH from the publ. "Apparatura i Metody Izmereniya Sily Tyazhesti Namore" Moscow, Nauka, 1970 p 86-88
(AD-737475; ACIC-TC-1785) Avail: NTIS CSCL 14/2

It has been shown experimentally that when a pendulum is influenced by forces directed parallel to the thread axis, the pendulum can rotate in a horizontal plane. A device has been assembled to measure this pendulum rotation, and it has been shown that when the elastic system is tilted in the plane of the threads the angle of the pendulum's turn in the horizontal plane can reach 5 angular minutes. Author (GRA)

N72-23493# Aeronautical Chart and Information Center, St. Louis, Mo. Technical Translation Section.
BENCH TESTS OF Gss-2 GRAVIMETERS
Yu. P. Izmailov Jan. 1972 14 p refs Transl. into ENGLISH from the publ. "Apparatura i metody izmereniya sily tyazhesti na more" Moscow, Nauka, 1970 p 88-93
(AD-737476; ACIC-TC-1786) Avail: NTIS CSCL 08/5

The study presents the data on the bench tests of the gravimeters Gss-2 under given vertical and horizontal accelerations with alternating signs. It shows that the experimental results correspond to the theoretical computations. The amplitude-frequency characteristic of the gravimeter has been obtained.
Author (GRA)

N72-23494# Texas Univ., Austin. Applied Research Labs.
[MODIFICATIONS TO ACOUSTIC VELOCIMETER FOR USE DURING SEDIMENT CORING] Final Report, 15 Apr. 1971 - 15 Jan 1972
17 Jan. 1972 29 p
(Contract N00014-70-A-0166-0005)
(AD-737338; ARL-TR-72-6; NR Proj. 291-050) Avail: NTIS CSCL 20/1

During the period 15 April 1971 to 15 January 1972, work on this project has included both the modification of the equipment and the taking of data with the equipment in its various stages of modification. Modifications include the replacement of laboratory type equipment with less bulky printed circuits and the manufacture of new cutting heads to fit existing coring tools. Data were taken on three field trips, two of which were to the Gulf of Mexico aboard A and M research vessels Orca and Alaminos and one to Baffin Bay, Texas, on a University of Texas research barge. The data upheld the feasibility of in situ measurements of acoustic velocity while coring. Author (GRA)

N72-23495# Xonics, Inc., Van Nuys, Calif.
[TURBULENT WAKE STATISTICS AND HYDRODYNAMIC FACILITY FOR STRATIFIED FLOW STUDIES] Final Technical Summary Report
Dec. 1971 84 p refs
(Contract DAAH01-71-C-1024; ARPA Order 360)
(AD-736646) Avail: NTIS CSCL 14/2

The report covers work performed on two major tasks. The first was to perform additional data reduction and processing of Lagrangian data on turbulent wakes. The second task was the restoration of the hydrodynamic facility developed under a prior contract and the design of modifications of that facility for use in the study of stratified flows, particularly momentumless wakes.
Author (GRA)

N72-23281*# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
FRAME TYPE IMAGING SENSORS
George Barna *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 20 p Sponsored by NASA (See N72-23280 14-13)
(NASA-CR-126422) Avail: NTIS HC $3.00 CSCL 08G

N72-23282 Hughes Aircraft Co., Los Angeles, Calif.
SCANNING TYPE IMAGING SENSORS
Virginia T. Norwood *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 8 p (See N72-23280 14-13)
Copyright. Avail: Issuing Activity

N72-23283*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PASSIVE MICROWAVE SENSORS
Warren Hovis *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 11 p ref (See N72-23280 14-13)
(NASA-TM-X-67710) Avail: NTIS HC $3.00 CSCL 14B

N72-23545# Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF MEASUREMENT GEOMETRY BY NEUTRON ABSORPTION ANALYSIS OF THE AMOUNT OF CADMIUM AND BORON IN A FLOW OF PULPS AND SOLUTIONS
S. F. Kuzkin, V. P. Nebera, and Yu. P. Kornilov *In its* Bull. of the Inst. of Higher Learning, Nonferrous Met. 4 May 1972 p 144-149 refs (See N72-23539 14-17)
Avail: NTIS HC $4.75

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication; friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N72-23496*+ North American Rockwell Corp., Seal Beach, Calif. Space Div.
SATURN S-11 PRODUCTION OPERATIONS TECHNIQUES, PRODUCTION WELDING. VOLUME 3: CIRCUMFEREN TI-AL WELDING
D. G. Abel et al 30 Oct. 1970 323 p
(Contract NAS7-200)
(NASA-CR-123485; SD-70-559-3-Vol-3) Avail: NTIS HC $18.25 CSCL 13H

Special processes and techniques are described for the circumferential welding of Saturn 2 cylinder and bulkhead assemblies to complete the LO2 and LH2 tankage and to maximize efficiency and personnel performance during S-2 follow-on or restart activities. The processes are only applicable to aluminum alloys within the 2000 series. Author

N72-23497* Boeing Co., Cocoa Beach, Fla.
POSITIVE CONTACT RESISTANCE SOLDERING UNIT Patent
Robert D. Banta, inventor (to NASA) Issued 16 Nov. 1971 4 p Filed 21 Sep. 1971 Sponsored by NASA
(NASA-Case-KSC-10242; US-Patent-3,621,193; US-Patent-Appl-SN-73834; US-Patent-Class-219-234; US-Patent-Class-219-85; US-Patent-Class-219-109; US-Patent-Class-324-65R) Avail: US Patent Office CSCL 13I

The development of a positive contact resistance soldering unit is discussed. The unit has a relay which is operated by a foot switch for selectively coupling a milliohmmeter to the electrodes and the workpiece to determine the area of best contact. When the milliohmmeter indicates that the electrodes are in good contact with the workpiece, the foot switch is depressed to connect the output of a power transformer to the electrodes to begin the soldering operation. P.N.F.

N72-23498*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APOLLO 14 COMPOSITE CASTING DEMONSTRATION Final Report
I. C. Yates, Jr. Oct. 1971 78 p refs
(NASA-TM-X-64641) Avail: NTIS HC $6.00 CSCL 13H

The purpose of the demonstration was to show that mixtures of materials of different specific gravities would remain stable in the liquid state and during freezing in low g and not segregate as they do on earth. An inflight demonstration was performed on the Apollo 14 mission during the translunar and and transearth coast periods. The apparatus consisted of an electrical heater, a heat sink device for cooling, and sealed metal capsules containing matrix materials having a low-melting point and dispersants. The evaluation of the demonstration samples was accomplished by comparing space processed (flight) samples with (control) samples processed on the ground under otherwise similar conditions. In the low q environment of space flight the dispersions of particles, fibers, and gases in a liquid metal matrix

were maintained during solidification. Dispersions of normally immiscible liquids were also maintained during solidification.
Author

N72-23499*# Martin Marietta Corp., Denver, Colo.
INVESTIGATION OF LOW-COST ABLATIVE HEAT SHIELD FABRICATION FOR SPACE SHUTTLES
Huel H. Chandler Feb. 1972 112 p refs
(Contract NAS1-10793)
(NASA-CR-112045; MCR-72-51) Avail: NTIS HC $7.75 CSCL 22B

Improvements in the processes and design to reduce the manufacturing costs for low density ablative panels for the space shuttle are discussed. The areas that were studied included methods of loading honeycomb core, alternative reinforcement concepts, and the use of reusable subpanels. A review of previous studies on the fabrication of low-cost ablative panels and on permissible defects that do not affect thermal performance was conducted. Considerable differences in the quoted prices for ablative panels, even though the various contractors had reported similar fabrication times were discovered. How these cost differences arise from different estimating criteria and which estimating assumptions and other costs must be included in order to arrive at a realistic price are discussed. Author

N72-23500*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
CROSS FLOW IN A STARVED EHD CONTACT Apollo Guidance, Navigation and Control
Edward P. Kingsburg Mar. 1972 17 p refs Presented at the ASLE Ann. Meeting, Houston, Tex., 1-4 May 1972
(Contract NAS9-4065; DSR Proj. 55-23829)
(NASA-CR-115538; E-2648) Avail: NTIS HC $3.00 CSCL 11H

An analysis of lubrication cross flow effects under starved elastohydrodynamic conditions is presented. Starvation is defined as any operating condition such that an increase in oil available to the contact will result in an increase in film thickness. Starved EHD behavior is considered in several situations: (1) when no new oil enters the contact, and (2) when a step change in one of the rolling parameters is introduced at an equilibrium contact. Based on the fact that important oil flow within the Hertz zone is across the rolling contact direction, it is possible to formulate a simple theory which explains quantitatively some aspects of starved ball bearing behavior. Author

N72-23501# Boeing Scientific Research Labs., Seattle, Wash. Aerospace Group.
STRESS DISTRIBUTION AND DISPLACEMENTS IN A LUBRICATED ELASTIC SEAL
F. Edward Ehlers Sep. 1971 43 p refs
(D180-14141-1) Avail: NTIS HC $4.25

Milne-Thomson's complex variable method of plane elastic stress is used to study the stresses and displacements in an elastic seal of rectangular cross section. The boundary condition requiring only tangential displacements on the fixed wall results in an integral equation for the normal stress distribution on the seal where it contacts the housing. Surfaces of the seal touching the shaft and housing are assumed to be lubricated and therefore shear forces vanish on all boundaries of the seal. The solution of the integral equation for a semi-infinite seal is found and detailed calculations of the stresses and displacements in the vicinity of the air gap near the shaft are presented. One feature of the normal stress distribution is the large value near the corner of the housing at the air gap and the rapid falling off of the stress to nearly the value at infinity in only two of three gap distances along the housing wall from the gap. Author

N72-23502# Joint Publications Research Service, Washington, D.C.
MECHANICS: THE AGELESS SCIENCE
Ye. P. Moskatov 27 Apr. 1972 15 p Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 2, Feb. 1972 p 50-59
(JPRS-55819) Avail: NTIS HC $3.00

The organization and operation of the Institute of Problems of Mechanics of the Russian Academy of Sciences are discussed. Parts of the organization which are described are: (1) laboratory for mechanics of plasma, (2) laboratory for mechanics of polymers, (3) department of optimal control of motion, (4) shock wave laboratory, and (5) laboratory for the mechanics of anomalous liquids. Author

N72-23503*# Southwest Research Inst., San Antonio, Tex.
MAGNETIC PERTURBATION INSPECTION OF INNER BEARING RACES
John R. Barton and James Lankford Washington NASA May 1972 63 p refs
(Contract NAS3-13944)
(NASA-CR-2055; SWRI-15-2773) Avail: NTIS HC $3.00 CSCL 13I

Approximately 100 inner race bearings were inspected nondestructively prior to endurance testing. Two of the bearings which failed during testing spalled at the sites of subsurface inclusions previously detected by using magnetic field perturbation. At other sites initially judged to be suspect, subsurface inclusion-nucleated cracking was observed. Inspection records and metallurgical sectioning results are presented and discussed.
Author

N72-23504*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEW CIRCUMFERENTIAL SEAL DESIGN CONCEPT USING SELF-ACTING LIFT GEOMETRIES
William F. Hady and Lawrence P. Ludwig Washington May 1972 11 p refs
(NASA-TN-D-6805; E-6821) Avail: NTIS HC $3.00 CSCL 11A

Seal operating temperatures, leakage (pressurizing gas flow), torque, and wear of a conventional circumferential shaft seal were measured and compared to those of a conventional seal modified to have self-acting lift geometries. Both seal types had a 2.625-in diameter bore and were operated at a sliding velocity of 150 ft/sec with differential pressures ranging from 0 to 100 psi. Results of this investigation show that the self-acting seal operated at lower bulk carbon temperatures with half the torque and approximately one-tenth the wear of the conventional seal. Seal leakage of the self-acting seal was of order of 0.04 scfm for pressures above 60 psi which is well within the accepted range for gas turbine engine applications. Author

N72-23505# Addis Translations International, Woodside, Calif.
REASONS FOR THE DEVELOPMENT OF CLEAN BURNISHED SURFACES IN METAL CUTTING
F. Betz Oct. 1971 22 p refs Transl. into ENGLISH of paper presented at 21st Gen. Assembly of CIRP (Intern. Inst. for Production Eng.), Warsaw, 1-6 Sep. 1971 "Ursachen fuer die Entstehung Glatter Schnittflaechen bei der Metallzerspanung" Zurich, Federal Coll. of Eng. (ETH), Inst. for Machine Tools and Production Technol., 1971 Prepared for Calif. Univ., Livermore. Lawrence Radiation Lab.
(UCRL-Trans-10564) Avail: NTIS

The metallurgical processes leading to the production of clean burnished surfaces during metal cutting are discussed. The microstructure of a workpiece surface produced in metal cutting depends on the cutting speed. Normally a clean burnished surface in the cutting direction is produced only at a certain high temperature of the order corresponding to the alpha-gamma transformation at the tool flank. It was determined that the microstructure of the surface depends upon the position of the stagnation zone which is formed ahead of the cutting tool. Clean surfaces can be produced at any cutting speed provided the stagnation zone is suitably positioned with respect to the cutting edge of the tool. Author

N72-23506# Bendix Corp., Kansas City, Mo.
BIBLIOGRAPHY: MACHINING MINIATURE PARTS AND MINIATURE FEATURES
L K. Gillespie Dec. 1971 31 p refs
(Contract AT(29-1)-613)
(BDX-613-585) Avail: NTIS

A comprehensive bibliography is presented together with a subject index keyed to articles, reports, and brochures on machining miniature parts and miniature features. There are 226 references. Author

N72-23507# Los Alamos Scientific Lab., N.Mex.
FLUIDIZED-BED AND ELECTROSTATIC SPRAY COATING: APPLICATION TECHNIQUES TO OBTAIN SPECIAL EFFECTS
Stephen E. Newfield and Roscoe A. Faussone Nov. 1971 3 p
(Contract W-7405-eng-36)
(LA-4766) Avail: NTIS

Certain special techniques have been used to achieve polymeric coatings by fluidized-bed and electrostatic spray methods. These two related methods are discussed to outline some of the problems. Unusual end use requirements demand procedures that are not routine to these coating methods. Ideas for coating very thin metals, for providing special mandrel release surfaces, and for metal plating a mandrel for dimensional control are discussed. Author

N72-23508# Auburn Univ., Ala. Dept. of Mechanical Engineering.
STUDY OF THE ONSET OF PERMANENT DEFORMATION IN STRUCTURALLY BONDED JOINTS Final Report, 29 Jun. 1970 - 31 Dec. 1971
Wartan A. Jemian and Roy C. Wilcox Jan. 1972 88 p refs
(Contract DAAH01-70-C-1425)
(AD-736875) Avail: NTIS CSCL 13/5

The fracture toughness of aluminum-epoxy-aluminum samples in the lap-shear configuration was studied by the strain energy release rate approach. Specific effects of curing cycle, adhesive modulus, and sample dimensions were studied and reported. Author (GRA)

N72-23509# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
BALLISTIC VULNERABILITY OF BORON/EPOXY DOUBLE WALL DRIVE SHAFTS Final Report, Feb. - Jun. 1971
Robert T. Welge and Frank H. Veit Fort Eustis, Va. USAAMRDL Oct. 1971 45 p refs
(Contract DAAJ02-71-C-0021)
(AD-737285; USAAMRDL-TR-71-50) Avail: NTIS CSCL 13/9

Seven boron/epoxy double-wall shafts were ballistically impacted while under torque loads ranging from 7,500 to 12,300 in.-lb. Projectile velocities ranged from 1,540 to 2,500 fps. Static residual strength tests were then conducted. Three aluminum shafts were tested similarly for comparison. The residual strength of the boron/epoxy shafts was approximately 8,000 in.-lb, which is about one-third the ultimate strength of an undamaged tube. The aluminum shafts exhibited residual strengths of 22,000 to 32,000 in.-lb, which would be sufficient to carry expected flight loads. Author (GRA)

N72-23510# Army Missile Command, Redstone Arsenal, Ala.
SHORT TIME ELEVATED TEMPERATURE MECHANICAL BEHAVIOR OF 2014-T6 ALUMINUM ALLOY WELDMENTS
Clarence W. Austin, Jr. 23 Aug. 1971 83 p refs
(DA Proj. 1T0-62105-A-328)
(AD-737195; RR-TR-71-12) Avail: NTIS CSCL 13/5

The influence of loading rate and exposure time at temperature on the short-time elevated temperature mechanical behavior of naturally aged and artificially aged 2014-T6 aluminum alloy weldments was investigated in the 75 to 800F temperature range. The interrelation of the strength, ductility, and fracture location in these weldments with the microstructure of the heat-affected zone and changes in the microstructure of this zone during elevated temperature exposure are described. Author (GRA)

N72-23511# Martin Marietta Corp., Orlando, Fla.
MANUFACTURING METHODS AND TECHNOLOGY STUDY COVERING METHODS FOR MANUFACTURING ELECTRONIC MODULES Final Report, Jul. 1970 - Jul. 1971
Sol C. Osborne, Charles E. Brown, Melvyn O. Samuelson, and Frederick E. Tartaglia Jul. 1971 222 p refs
(Contract DAAH03-71-C-0006)
(AD-737187; OR-11220; ILE-TR-71.1) Avail: NTIS CSCL 09/5

The document is the final report on a three phase program for MICOM to establish advantages and disadvantages of numerical control production of MICOM missile system electronics; establish needs, modifications, improvements, or developments needed for numerical controlled or mechanized production of missile electronics; and design a numerical control fabrication center for missile systems electronics. Author (GRA)

N72-23512# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICAL PRINCIPLES OF ULTRASONIC TECHNOLOGY, SELECTED EXCERPTS
L. D. Rozenberg, ed. 30 Nov. 1971 392 p refs Transl. into ENGLISH from monograph "Fizicheskie Osnovy Ultrazvukovoi Teknologii, Vol. 3" 1970 243 p
(AD-736909; FTD-MT-24-895-71) Avail: NTIS CSCL 13/8

The following questions are examined: ultrasonic cutting, and surface finishing of materials; degasification of liquids; and crystallization of metals. GRA

N72-23513# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRESS MOLDS FOR METALLURGY: DESIGN AND CONSTRUCTION
I. D. Radomyselskii, E. L. Pechentkovskii, and G. G. Serdyuk 19 Nov. 1971 219 p refs Transl. into ENGLISH of the book "Press-Formy Dlya Poroshkovoi Metallurgii: Raschet i Konstruirovanie" Kiev, Izd-vo Tekhnika, 1970 p 1-170
(FTD Proj. 60108)
(AD-736907; FTD-MT-24-17-71) Avail: NTIS CSCL 13/9

The technological principles and classification of the methods of formation of cermet articles are presented, the principles of constructing press molds for cold and hot pressing of articles from metallic powders are stated, and also the repressing and calibration of these articles. Methods are given for designing of dies and other parts of press molds; some features of the technology of manufacture are considered. Author (GRA)

N72-23514# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE COEFFICIENT AS A MEASURE OF FRICTION, AND METHODS OF MEASURING IT
Stefan Ziemba and Monika Gierzynska 1 Dec. 1971 29 p refs Transl. into ENGLISH from Politech., Czestochowa, Zeszyty Naukowe, Nauki Techniczne (Poland), no. 1, 1969 p 217-246
(AF Proj. 7343)
(AD-736884; FTD-HC-23-956-71) Avail: NTIS CSCL 20/11

An analysis is given of the concept of the friction coefficient as a measure of friction within the framework of different friction hypotheses. The current lack of a unique definition of the friction coefficient is noted, and the importance of introducing such a definition is emphasized. Methods of studying frictional resistance, and the requirements placed on the respective measuring equipments are reviewed, with particular reference to methods of measuring friction in the plastic working of metals. Author (GRA)

N72-23515# Midwest Research Inst., Kansas City, Mo.
EXPERIMENTAL INVESTIGATION OF AgHg-WTFE-MoSe2 SOLID LUBRICATED BALL BEARINGS FOR HIGH SPEED,

HIGH TEMPERATURE, AND HIGH LOAD APPLICATIONS Technical Report, Dec. 1968 - Oct. 1971
Ronald D. Dayton Jan. 1972 52 p refs
(Contract F33615-69-C-1265; AF Proj. 3048)
(AD-736838; AFAPL-TR-71-100) Avail: NTIS CSCL 13/9

The report presents the results of 30 functional ball bearing tests using AgHg-WTFE-MoSe2 composite retainers. For the most part, these tests were conducted at a bearing speed of 10,000 rpm, a bearing temperature of 600F, and a combined loading of 50-lb axial and 50-lb radial. The objectives of these tests were: (1) to determine the effect on bearing life of any retainer unbalance which might be present after final machining; (2) to determine an optimum bearing-retainer geometry for maximum bearing life; and (3) to further develop the bearing-retainer geometry in order to increase bearing life. Lubricant material studies were also conducted using Differential Thermal Analysis and X-ray emission analysis to accurately establish modified Teflon (WTFE) melting points and material compositions. Author (GRA)

N72-23516# Naval Academy, Annapolis, Md. Div. of Engineering and Weapons.
COMPUTER AIDED NUCLEATION NOZZLE DESIGN
Andrew A. Pouring Oct. 1971 57 p refs
(Contract DI-14-06-D-7119)
(AD-737395; EW-72-1) Avail: NTIS CSCL 13/7

As an aid to designing nozzles for use in the homogeneous seeding of clouds, the one-dimensional equations of motion for a compressible, inviscid flow of air and water vapor are solved together with the classical nucleation rate equations for any arbitrary nozzle profile. The occurrence of shockwaves at high initial humidities is sensed and transition calculated by the Rankin-Hugoniot shock relations. Onset of condensation in the nozzle is observable by plots of condensate versus distance; other thermodynamic parameters are also obtained. Results are compared with previous experimental findings and limitations of the design procedure are discussed. Author (GRA)

N72-23517# Mechanical Technology, Inc., Latham, N.Y.
RESEARCH ON ELASTOHYDRODYNAMIC LUBRICATION ON HIGH SPEED ROLLING-SLIDING CONTACTS Annual Report, 1 Feb. 1970 - 1 Feb. 1971
Richard L. Smith, Jed A. Walowit, Pradeep K. Gupta, and John M. McGrew Wright-Patterson AFB, Ohio AFAPL Dec. 1971 176 p refs
(Contract F33615-69-C-1305; AF Proj. 3048)
(AD-737374; AFAPL-TR-71-54; AR-2) Avail: NTIS CSCL 11/8

A rolling disc apparatus has been designed and built. Tractions between two crown discs lubricated with 5P4E polyphenyl ether have been measured as function of slip rate over a range of Hertz pressure (80,000-140,000 psi), rolling speeds (900-1820 ips), and temperatures (175 F - 215 F). Comparisons are made between measured tractions, Battelle data, and various analytical predictions. Author (GRA)

N72-23518# Admiralty Surface Weapons Establishment, Portsmouth (England).
COMPONENT FAILURE RATES AND THEIR ROLE IN RELIABILITY PREDICTION
N. A. Walter and P. M. Watson Oct. 1971 24 p refs
(AD-737253; ASWE-TR-71-31; BR28023) Avail: NTIS CSCL 14/4

The report details various sources of failure rate data, illustrating their uses and limitations. Failure rate data from eight sources is included. The principles involved in using this data to predict equipment reliability are included, and examples of the type of calculation involved for various systems are fully described. Useful predictions are possible but great care is necessary both in the choice of failure rate data and the actual use to which the prediction is put. Brief mention is made of other methods of prediction, such as multiple regression analysis. Author (GRA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N72-23519*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE HEIGHT DETERMINATION USING SATELLITE-TO-SATELLITE TRACKING AND GROUND LASER SYSTEMS
F. O. VonBun Mar. 1972 15 p refs Presented at Sea Surface Topography Conf., Key Biscayne, Fla., 5 Oct. 1971
(NASA-TM-X-65867; X-550-72-67) Avail: NTIS HC $3.00 CSCL 20E

The height of the GEOS-C spacecraft was utilized as measured by the onboard radar altimeter, for an improved determination of the earth's gravitational field and for the determination of the variation of the physical surface of the oceans. Two tracking system approaches to accurately determine the spacecraft height (orbit) are described and their results stated. These are satellite-to-satellite tracking (SST) and ground laser tracking (GLT). Height variations can be observed in the dm-regions using SST and in the m-region using present GLT. Author

N72-23520# Lockheed Missiles and Space Co., Palo Alto, Calif.
LASER LOCATION OF THE LIGHT-REFLECTOR MOUNTED ON THE LUNOKHOD-1
Iu. L. Kokurin, V. V. Kurbasov, V. F. Lobanov, A.N. Sukhanovskii, and N. S. Chernykh [1972] 8 p refs Transl. into ENGLISH from Kosm. Issled. (USSR), v. 9, no. 6, 1971 p 912-919
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Results are presented for experiments on laser location of the light reflector mounted on the Lunokhod 1. Reflection parameters, and a description of the laser locating apparatus, are given. It is shown that measurement accuracy is within + or - 3 m. Author

N72-23521*# Scientific Translation Service, Santa Barbara, Calif.
HOLOGRAPHY
Yu. I. Ostrovskiy Washington NASA May 1972 128 p refs Transl. into ENGLISH of the book "Golografiya" Leningrad, 1970
(Contract NASw-2035)
(NASA-TT-F-706) Avail: NTIS HC $3.00 CSCL 20E

Holography, i.e., the interference-diffraction method of recording and reconstituting wavefronts, is discussed. Applications of the method in optics, radar, acoustics, instrumentation, and other areas of science and technology are reviewed. An exposition of the properties of holograms and experimental holographic techniques are also described. Author

N72-23522# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE NATURE OF THE REMOVAL OF A SUBSTANCE UNDER THE EFFECT OF LASER RADIATION ON MATERIAL WITH DIFFERENT THERMOPHYSICAL PROPERTIES
M. V. Orekhov and B. S. Slavin 1972 4 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 16, no. 1, 1972 p 153-155
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

High speed photographic recordings of flares originating on a ferrite and a steel plate under the effects of pulsed ruby laser radiation are analyzed. Comparison of radiation pulse time sweeps and their corresponding flares show that the jet escape of the plasma is less definite for steel. The wave-like time development of the flare from steel is attributed to cratering

which shapes the loss product into a directed jet whose depth increases as light energy enters the zone of action, leads to heating and rupturing of the crater walls, and results in their melting and partial evaporation. Accumulation of melt on the walls causes shaping of the loss product into a directed jet, and vapor pressure drop at the crater bottom and flare diminution. The process repeats itself as the power density at the bottom of the lune increases subsequently. A similar phenomenon is not observed for a ferrite because of its lower temperature conduction coefficient and the negligible quantity of liquid phase being formed in crater wall heating. G.G.

N72-23523# Illinois Univ., Urbana.
NUCLEAR RADIATION ENHANCEMENT OF CO2 LASER PERFORMANCE
T. Ganley, J. T. Verdeyen, and G. M. Miley 1971 6 p refs Presented at 20 Symp. on Uranium Plasmas, Atlanta, 15-17 Nov. 1971 Submitted for publication
(Contract AT(11-1)-2007)
(Conf-711124-1) Avail: NTIS HC $3.00

The effect of nuclear radiation on the operation of electrically excited CO2 lasers is discussed. Three types of experiments and results are presented: (1) low-pressure CW laser; (2) low-pressure pulsed laser; and (3) high-pressure TEA pulsed laser.
Author (NSA)

N72-23524# Addis Translations International, Woodside, Calif.
HIGH-POWER LASERS FOR HIGH-TEMPERATURE HEATING OF PLASMA
P. G. Kryukov and Yu. V. Senatskii 1971 25 p refs Transl. into ENGLISH from the report "Moshchnye Lazery Vysokotemperaturnogo Negreva Plazmy" Moscow, 1971 Prepared for Calif. Univ., Livermore. Lawrence Livermore Lab.
(UCRL-Trans-10578) Avail: NTIS HC $3.25

The main features of the design of high power Nd glass lasers for the high temperature heating of plasma are discussed. The use of laser radiation at the harmonic frequencies in heating experiments seems very interesting. Results show more than 50 percent efficiency of the Nd glass laser energy conversion into SHG. The use of SHG radiation has the following attractive features; it becomes possible to heat denser plasma, the laser-target feedback partially disappears, and the parameters of the laser pulse, in particular the contrast, are improved. NSA

N72-23525# Institut Franco-Allemand de Recherches, St. Louis (France).
HOLOGRAPHIC ANALYSIS OF DISCHARGES IN TRANSVERSELY PUMPED CARBON DIOXIDE LASERS [HOLOGRAPHISCHE UNTERSUCHUNG DER ENTLADUNG-SKONFIGURATION TRANSVERSAL GEPUMPTER CO2-LASER]
M. Hugenschmidt and K. Vollrath 16 Aug. 1971 32 p refs In GERMAN
(ISL-21/71) Avail: NTIS HC $3.75

The electric discharge configuration for transverse pumping of two small carbon dioxide lasers was investigated by impulse holographic interferometry. Stabilization of the single discharges as well as simultaneous arc-through was obtained by cathode resistors. The electrodes were mounted either in one plane, or helically around the tube's axis. The discharges were observed in the endon direction, for which the laser mirror was replaced by a quartz plate. The holograms show refractive anisotropy along the resonator axis and density gradient decoy as a function of time. Author (ESRO)

N72-23526# Army Electronics Command, Fort Monmouth, N.J.
EFFECTS OF PULSING A CO2 LASER AMPLIFIER
Paul R. Blaszuk (Rensselaer Polytechic Inst.), Jack H. Noon (Rensselaer Polytechnic Inst.), Ernest H. Holt (Rensselaer Polytechnic Inst.), and Rudolf G. Buser Sep. 1971 42 p refs
(DA Proj. 1T0-61102-B-31A)
(AD-737173; ECOM-3466) Avail: NTIS CSCL 20/5

The pulsed CO2 discharge has been studied to determine the gain available for laser amplification at 10.6 microns. Negative gain was observed following the termination of the first voltage pulse on a pure CO2 gas sample but on repetitive pulsing positive gain is observed both in the active discharge and the afterglow. A combination of microwave and optical gain measurements show that an electron impact excitation of the bending mode of CO2 molecule can bottleneck the decay of the laser level. The evolution of CO from the gas sample on repetitive pulsing shown to affect the gain behavior. The work reported can explain discrepancies in the literature concerning determination of the lower laser level lifetime by pulsed discharge and induced fluorescence techniques. Author (GRA)

N72-23527# Army Electronics Command, Fort Monmouth, N.J.
CHARACTER IDENTIFICATION BY HOLOGRAPHY AND COHERENT SPATIAL FILTERING
George Constantinou Oct. 1971 30 p refs
(DA Proj. 1H6-62701-A-484)
(AD-737182; ECOM-3494) Avail: NTIS CSCL 09/2

Techniques of coherent spatial filtering for character reading are examined. Fourier holograms are used as filters. Methods for improving character selectivity are investigated. The practical considerations for applying these techniques are discussed and the advantages of a coherent optical character reader over a conventional one are listed. Author (GRA)

N72-23528# Naval Training Device Center, Orlando, Fla.
HOLOGRAPHY
Alfred H. Rodemann, Denis R. Breglia, and Windell N. Mohon Jan. 1972 25 p refs
(AD-736926; NAVTRADEVCEN-TN-20) Avail: NTIS CSCL 14/5

A thorough survey is presented of the relatively new science of holography. The survey includes a somewhat extensive synopsis of the historical background of the subject. A clear and concise description is given of the physical aspects of holography including an analogy to photography. A mathematical analysis is given of off-axis type holograms. Experimental apparatus is discussed and photographs show actual laboratory setups. The required coherence length of a laser is mentioned. Methods of image reconstruction are illustrated. Several examples of applications are listed along with methods of deployment. One method of making 360 degree holograms is introduced. A bibliography is given of the most recent text books available on the subject. Author (GRA)

N72-23529# Wayne State Univ., Detroit, Mich. Research Inst. for Engineering Sciences.
MODELING OF A PULSED CO/N2 MOLECULAR LASER SYSTEM Scientific Interim Report
George Abraham and Edward R. Fisher Oct. 1971 49 p refs
(Contract DA-ARO(D)-31-124-71-G82; ARPA Order 675)
(AD-736928; RIES-71-39) Avail: NTIS CSCL 02/5

A detailed numerical model has been developed for characterizing the important energy transfer processes operative in the CO/N2 direct current discharge laser system. The model is based upon a rate equation formulation which includes 30 levels of both CO and N2 and treats multi-quantum electron-molecule excitation processes, single quantum vibration-vibration exchange and vibration-translation energy transfer processes and both harmonic and overtone spontaneous emission terms. In this paper the time evolution of the CO vibrational distributions with and without N2 is calculated and the associated small signal gain is predicted and compared to the measurements of Jeffers and Wiswall. Author (GRA)

N72-23530# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.
[ELECTRON BEAM DEVICES, QUANTUM ELECTRONIC, PLASMA, AND SOLID STATE DEVICES OPERATING AT OPTICAL FREQUENCIES] Consolidated Quarterly Report,

1 Apr. - 30 Jun. 1971
R. L. Arnold, P. W. Chen, C. H. Durney, O. P. Gandi, and R. W. Grow 30 Jun. 1971 141 p refs
(Contract N00014-69-C-0345; Grant NSF GK-16574; NR Proj. 373-740)
(AD-736935; MDL-Q37; UTEC-MD-71-206) Avail: NTIS CSCL 20/5

The broad purpose of the research activity reported herein is to extend the useful frequency spectrum into the range from microwave frequencies to optical frequencies and to improve existing devices and techniques in the microwave spectrum. At present this objective is being pursued by studies of electron beam devices, quantum electronic devices, plasmas, and solid-state devices. Author (GRA)

N72-23531# Naval Postgraduate School, Monterey, Calif.
THE CO2-HN3 LASER
Daniel J. Collins and Gunther P. Schnez Oct. 1971 100 p refs
(AD-735252; NPS-57CO71101A) Avail: NTIS CSCL 20/5

The report contains the results obtained during the first year of investigations into the phenomena of chemically pumped lasers. The primary emphasis during this first year has been the design and fabrication of CO2-HN3 laser. The major highlights of the developmental work are (1) design and fabrication of the laser tube and resonant cavity, (2) design, construction and operation of the HN3 generating and gas filling systems and (3) flashlamp discharge circuit design and development of the charging control system. Further work was conducted in the computer simulation of the experiment and in the addition of a monochromator to the experimental equipment. Author (GRA)

N72-23532# Perkin-Elmer Corp., Wilton, Conn.
DIGITAL COMPUTER SIMULATION PROGRAMS FOR ELECTROSTRICTIVE LASER BEAM TRAPPING
Edwin L. Kerr Oct. 1971 56 p refs
(Contract F19628-69-C-0220; AF Proj. 4645)
(AD-737384; PE-10804; AFCRL-71-0552; SR-3) Avail: NTIS CSCL 20/5

A package of computer programs for simulating electrostrictive laser beam trapping is documented. Experimentally, a sufficiently powerful laser pulse can focus itself into a long, thin filament by electrostrictively compressing experimental conditions and three discretization parameters. The output is a printed computer movie showing the beam propagation trajectory at selected intervals during the laser pulse, and a graph of peak achieved intensity along the beam axis. The movie may also be plotted. Author (GRA)

N72-23972# Naval Research Lab., Washington, D.C. Metal Physics Branch.
A LASER FLASH TECHNIQUE FOR DETERMINING THERMAL DIFFUSIVITY OF LIQUID METALS AT ELEVATED TEMPERATURES
J. T. Schriempf *In its* NRL Progr. Rept. Feb. 1972 p 9-17 refs (See N72-23970 14-34)
Avail: NTIS HC $4.50

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N72-23533*# Houston Research Inst., Inc., Tex.
OPTIMUM OUTGASSING CYCLES FOR ALUMINUM AND STAINLESS STEEL Final Report
R. L. Garrison 3 Dec. 1970 29 p refs
(Contract NAS9-6698)
(NASA-CR-115560) Avail: NTIS HC $3.50 CSCL 11F

Outgassing rates were measured for a modified 7075T6 aluminum and 304L stainless steel, for two degrees of finish, at temperatures of 285 deg F to 392 deg F, for times of 0.5 to 72 hours. The results were analyzed to determine optimum time and temperature cycles for outgassing. Optimum cycles were determined with and without the limitations of a graph. The graph related allowable time at temperature to a 5 percent or less reduction in room temperature properties of 7075T6 aluminum. For aluminum, within the limits set by reduction in mechanical properties, the optimum cycle tested was 40 hours at 285 deg F. Disregarding the limits, optimum outgassing was achieved at the highest temperatures and longest times tested, for both aluminum and stainless steel. Author

N72-23534# Joint Publications Research Service, Arlington, Va.
MORPHOLOGY OF EUTECTIC IN Fe-W-C ALLOYS
Yu. N. Taran, L. I. Zivanov, and L. D. Moshkevich 27 Apr. 1972 8 p refs Transl. into ENGLISH from Metalloved. Term. Obrab. Metal. (Moscow), no. 1, 1972 p 2-6
(JPRS-55822) Avail: NTIS HC $3.00

The results of a study of the eutectic A + (W, Fe)6C, crystallizing in fast-cutting steels are summarized. In these steels eutectic conversion L yields A + (W, Fe)6C is the concluding stage of hardening, and the form of the eutectic colonies, and frequently their internal structures are obscured by previously formed austenite. It is shown that eutectic parts in cast fast-cutting type R18 steel represent cross sections of eutectic dendrite, but the large volume of the structurally free crystals of primary solid solution, and also the presence of local temperature and concentration gradients greatly distort the normal shape of the dendrites and introduce violations of their regular internal structure. Author

N72-23535*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DIFFUSION IN THORIATED AND NONTHORIATED NICKEL AND NICKEL-CHROMIUM ALLOYS AT 1260 C
John D. Whittenberger Washington May 1972 42 p refs
(NASA-TN-D-6797; E-6748) Avail: NTIS HC $3.00 CSCL 11F

Various solid-solid diffusion couples were assembled from thoriated and nonthoriated nickel-base alloys, welded, and diffusion annealed at 1260 C. Concentration profiles indicated that a thoria dispersion does not affect diffusion in Cr(alloy):Ni and Ni-4.8Al:Ni types of couples unless a fine grain structure is retained by the thoria particles. Metallography revealed the presence of thoria-free bands in the thoriated-Ni side of the diffusion zone. The bands contained grain boundaries and, in some cases, non-Kirkendall porosity. A mechanism based on the operation of vacancy sources is proposed to explain the thoria-free bands. In addition, a particular DS-NiCr:Ni couple had negligible Kirkendall porosity. This behavior was related to the grain structure of the particular lot of DS-NiCr. Author

N72-23536*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ALLOY HARDENING AND SOFTENING IN BINARY MOLYBDENUM ALLOYS AS RELATED TO ELECTRON CONCENTRATION
Joseph R. Stephens and Walter R. Witzke Washington May 1972 29 p refs
(NASA-TN-D-6810; E-6834) Avail: NTIS HC $3.00 CSCL 11F

An investigation was conducted to determine the effects of alloy additions of hafnium, tantalum, tungsten, rhenium, osmium, iridium, and platinum on hardness of molybdenum. Special emphasis was placed on alloy softening in these binary molybdenum alloys. Results showed that alloy softening was produced by those elements having an excess of s+d electrons compared to molybdenum, while those elements having an equal number or fewer s+d electrons that molybdenum failed to produce alloy softening. Alloy softening and alloy hardening can be correlated with the difference in number of s+d electrons of the solute element and molybdenum. Author

N72-23537# Joint Publications Research Service, Washington, D.C.
ELECTRON TRANSFER OF CARBON IN BERYLLIUM
V. P. Gladkov, V. S. Zotov, and D. M. Skorov 1 May 1972 4 p Transl. into ENGLISH from At. Energ. (Moscow), no. 2, 1972 p 163-164
(JPRS-55848) Avail: NTIS HC $3.00

The electron transfer of carbon in solid beryllium with a GPU-lattice was studied. Polycrystalline powdered metal with an average grain size of 56 microns was used. The samples were heated to operating temperatures of 1473 K, 1373 K, and 1273 K. Results of measurements of the carbon electron transfer at these three temperatures are presented in tabular form. Author

N72-23538# Joint Publications Research Service, Washington, D.C.
INFLUENCE OF SEMIFABRICATE PRODUCTION TECHNOLOGY ON THE MECHANICAL CHARACTERISTICS OF HEAT RESISTANT ALLOYS
A. F. Belov, N. D. Bobovnikov, and O. Kh. Fatkullin 4 May 1972 12 p Transl. into ENGLISH from Probl. Prochnosti (Kiev), no. 6, 1971 p 105-109
(JPRS-55879) Avail: NTIS HC $3.00

The methods used to improve the quality, economic effectiveness, and strength of metallurgical semifabricates are given. Data include vacuum melting and a duplex process that involves open electric arc smelting and vacuum arc remelting. Detailed results are given in tabular form. E.H.W.

N72-23539# Joint Publications Research Service, Washington, D.C.
BULLETIN OF THE INSTITUTES OF HIGHER LEARNING, NONFERROUS METALLURGY
4 May 1972 51 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Tsvet. Met. (USSR), No.
(JPRS-55880) Avail: NTIS HC $4.75

Developments in nonferrous metallurgy are discussed. Subjects presented are: (1) directed crystallization of eutectic alloys, (2) structure of the transition layer in the bimetal sheet-tin bronze, (3) influence of plastic deformation on relaxation of stresses in beryllium bronze, (4) method of producing composite aluminum alloys with equiaxial structure, and (5) optimization of process of tungsten trioxide reduction. For individual titles, see N72-23540 through N72-23547.

N72-23540# Joint Publications Research Service, Washington, D.C.
EQUILIBRIUM RATIO OF LOWER TITANIUM CHLORIDES IN A MEDIUM OF MELTED SODIUM AND POTASSIUM CHLORIDES
R. A. Sandler, E. I. Yaskelyaynen, and I. I. Ivanov *In its* Bull. of the Inst. of Higher Learning, Nonferrous Met. 4 May 1972 p 60-64 refs (See N72-23539 14-17)
Avail: NTIS HC $4.75

The basic research on investigating equilibrium has been done on the basis of low-concentration titanium-containing melts relative to the conditions of electrolytic production and refining of titanium. The data in these investigations, which are in accord, indicate that with transition from melts on a base of LiCl to melts on a base of CsCl the equilibrium is shifted to the left; additives of chlorides of alkali-earth metals to melts of alkali metals shift the equilibrium to the left. The investigations of equilibrium in high-concentration melts did not permit determining any definite relationships. Author

N72-23541# Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF DIRECTED CRYSTALLIZATION OF EUTECTIC ALLOYS
O. I. Fomichev, D. G. Borschevskaya, and T. M. Malchenko *In its* Bull. of the Inst. of Higher Learning, Nonferrous Met. 4 May 1972 p 130-132 refs (See N72-23539 14-17)
Avail: NTIS HC $4.75

An investigation of directed crystallization in eutectic alloys was conducted. The possibility of obtaining a directed eutectic structure in systems Pb-Sn, Bi-Cd, Cd-Zn, and Bi-Sn was examined. The directional hardening of alloys was done by the methods of controlled pulling from a melt and zone melting. Characteristic of all the samples produced was the presence of transverse bands of fracture in the regular structure, at the boundary of which the phase components are coarsened. Author

N72-23542# Joint Publications Research Service, Washington, D.C.
STRUCTURE OF THE TRANSITION LAYER IN THE BIMETAL STEEL-TIN BRONZE
R. I. Elbayeva *In its* Bull. of the Inst. of Higher Learning, Nonferrous Met. 4 May 1972 p 133-134 refs (See N72-23539 14-17)
Avail: NTIS HC $4.75

Tin bronzes are used in the process of manufacturing bimetallic sleeve bearings; these bronzes are deposited in the form of a thin film onto the inner surface of the steel billet. One of the most productive and economical methods for manufacturing such bearings is the method of centrifugal babbiting by melting the bronze chip inside the steel shell and heating with a high-frequency current. Heating with a high-frequency current ensures high rates of heat transfer and rapid melting of the light alloy. The investigations showed that a high strength of adhesion of the metals and a good filled layer are ensured by heating at a rate of 20 deg per second. Author

N72-23543# Joint Publications Research Service, Washington, D.C.
INFLUENCE OF PLASTIC DEFORMATION ON THE RELAXATION OF STRESSES IN BERYLLIUM BRONZE
S. V. Grachev and E. B. Adzhi-Asan *In its* Bull. of the Inst. of Higher Learning, Nonferrous Met. 4 May 1972 p 135-138 refs (See N72-23539 14-17)
Avail: NTIS HC $4.75

The influence of plastic deformation on the relaxation of stresses in beryllium bronze is discussed. The anomalous relaxation of stresses was observed only under test conditions when the alloy had a metastable structure. It is shown that cold plastic deformation of quenched beryllium bronze eliminates the anomalous kinetics of stress relaxation. The increase in electrical resistance at high temperatures is concluded to be caused by inverse dissolving of the previously precipitated phases. Author

N72-23544# Joint Publications Research Service, Washington, D.C.
METHOD OF PRODUCING COMPOSITE ALUMINUM ALLOYS WITH AN EQUIAXIAL STRUCTURE
R. R. Malinovskiy and V. I. Tararyshkin *In its* Bull. of the Inst. of Higher Learning, Nonferrous Met. 4 May 1972 p 139-143 refs (See N72-23539 14-17)
Avail: NTIS HC $4.75

For the purpose of reducing the size of the crystal structure of alloys a method of twostage crystallization was developed. The essence of the method involves the separation of the crystallization into two stages. The first stage takes place in a special device, immediately in front of the crystallizer, at a high rate of cooling. Cooling of the thin jets or drops of the melt takes place below the temperature of the liquids with the formation of primary intermetallide crystals. The as-yet insufficiently obtained liquid metallic suspension is guided into the crystallizer, where the second stage of crystallization is accomplished, the ingot is shaped and finally hardened. The high cooling rate of the alloy at the first stage ensures reduction in size of the crystal structure of the ingot. The devices for chilling the metallic flow in front of the crystallizer are described. Author

N72-23545# Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF MEASUREMENT GEOMETRY BY NEUTRON ABSORPTION ANALYSIS OF THE AMOUNT OF CADMIUM AND BORON IN A FLOW OF PULPS AND SOLUTIONS c14
S. F. Kuzkin, V. P. Nebera, and Yu. P. Kornilov *In its* Bull. of the Inst. of Higher Learning, Nonferrous Met. 4 May 1972 p 144-149 refs (See N72-23539 14-17)
Avail: NTIS HC $4.75

The development of sensors to determine the concentration of elements in moving liquid media is discussed. Several designs for sensors to determine the amount of cadmium in the flow of solutions and pulps using the neutron absorption method are described. Mathematical models of the sensor performance under various conditions are included. Variations in the design of the counters are illustrated. Author

N72-23546# Joint Publications Research Service, Washington, D.C.
OPTIMIZATION OF THE PROCESS OF TUNGSTEN TRIOXIDE REDUCTION
D. I. Lisovskiy, V. I. Tretyakov, V. A. Ivanov, and Ye. I. Gutov *In its* Bull. of the Inst. of Higher Learning, Nonferrous Met. 4 May 1972 p 150-152 refs (See N72-23539 14-17)
Avail: NTIS HC $4.75

The reduction of tungsten trioxide (WO3) with hydrogen in furnaces with a rotating tube is a complex multi-factor process that is virtually not amenable to determinant description. To construct a statistical model for it, it is necessary to solve the question of how many and what kind of factors should be taken into consideration. An informal choice may lead to an increase in the number of tests in the selective experiment and to ineffective results in investigating the surface of response. A statistical method of formalization of a priori information, which permits evaluating the comparative influence of the individual independent variables on the process of reduction is presented. Author

N72-23547# Joint Publications Research Service, Washington, D.C.
SEVERAL PROBLEMS IN ECONOMIC REFORM AT NONFERROUS METALLURGICAL ENTERPRISES c34
A. K. Doyev and I. A. Biryukov *In its* Bull. of the Inst. of Higher Learning, Nonferrous Met. 4 May 1972 p 153-158 (See N72-23539 14-17)
Avail: NTIS HC $4.75

Successful conversion to economic reform involves solving the most important methodological and organizational questions, one of which is the construction of a valid system of economic incentives and their utilization at maximal efficiency for increasing the productivity of labor, improving the quality of the manufactured products, and increasing the profitability of production. The basic sources for establishing types of economic incentives are wage funds and economic incentive funds, as well as prizes for mastering new techniques, for suggestions on efficiency and invention, for scrap metal delivery, and on results of socialist competition. The four-year experiment in working at a metallurgy plant under the new conditions of planning and economic incentive shows possibilities. Author

N72-23548# Joint Publications Research Service, Arlington, Va.
ANISOTROPY OF THE MECHANICAL PROPERTIES OF HEAT-RESISTANT ALLOYS ON A NICKEL BASE
S. B. Maslenkov, N. N. Burova, and T. V. Zemskaya 4 May 1972 5 p refs Transl. into ENGLISH from Metalloved. i Term. Obrabotka Metal. (Moscow), no. 1, 1972 p 70-71
(JPRS-55885) Avail: NTIS HC $3.00

Two factors influence the anisotropy of mechanical inclusions of highly doped heat resistant alloys. These factors are chemical heterogeneity and the degree of strengthening of the segments corresponding to the axes and interaxes that is associated with it. Most stable in the heat resistant alloys on a nickel base is the liquation of tungsten which leads to a heterogeneous decay in the elements of the filamentary structure after hot refining of the ingots and the assumed conditions of the heat treatment. At room temperature the anisotropy of the mechanical properties is basically associated with a heterogeneous distribution of the strengthening phase. To decrease the degree of anisotropy of the mechanical properties of nickel alloys it is necessary to increase their purity from nonmetallic inclusions. Author

N72-23549# Joint Publications Research Service, Arlington, Va.
THERMOPHYSICAL PROPERTIES OF POWDERED METAL COMPOSITIONS OF THE SYSTEM Al2O3-Mo
V. A. Osipova and Kh. A. Kryaar 4 May 1972 3 p Transl. into ENGLISH from At. Energ. (Moscow), no. 2, Feb. 1972 p 162
(JPRS-55886) Avail: NTIS HC $3.00

The thermophysical properties of the powdered metal compositions 80 percent Al2O3 + 20 percent Mo and 60 percent Al2O3 + 40 percent Mo at temperatures of 500 to 1300 deg K are determined through a complex method of monotonic heating and heat flux measurements. It is shown that the temperature dependence of the coefficient of thermal diffusivity is analogous to that of the coefficient of thermal conductivity. G.G.

N72-23550# Oak Ridge National Lab., Tenn.
LOW-TEMPERATURE OXIDATION OF U-Nb AND U-Nb-Zr ALLOYS
J. V. Cathcart and G. F. Petersen Dec. 1971 18 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3587) Avail: NTIS

The rates of oxidation of U-9.4 wt percent Nb and U-7.5 wt percent Nb-2.5 wt percent Zr were measured between 100 and 300 C in purified oxygen. An activation energy of approximately 13 kcal/mole was obtained for both alloys. The effects of H2O, SO2, and CCl4 on the oxidation rate of the ternary alloy was small. Metallographic studies revealed the oxide films to be compact and uniform, although significant oxidation rate anisotropy was observed during the early stages of oxidation. Author (NSA)

N72-23551# Bendix Corp., Kansas City, Mo.
STRAIN HARDENING EXPONENT FOR 17-4 PH STAINLESS STEEL
J. R. Mulkey Oct. 1971 34 p refs
(Contract AT(29-1)-613)
(BDX-613-577) Avail: NTIS

Strain hardening exponents were measured on three thicknesses of 17-4 PH stainless steel sheets. Based on these results, published values for strain hardening exponents were rejected and a range of 0.2 to 0.24 was recommended. This range is consistent with the experience of material and test engineers. Author

N72-23552# Illinois Univ., Urbana.
BREAKDOWN OF FILMS AND INITIATION OF PITS ON ALUMINUM
J. Zahavi and M. Metzger 1971 30 p refs Presented at U. R. Evans Intern. Conf. on Localized Corrosion, Williamsburg, Va., Dec. 1971 Sponsored in part by AEC and Army
(COO-1198-858; Conf-711205-1) Avail: NTIS HC $3.00

From electron-microscope studies of films formed at 5 mA/sq cm in 2.4 M H2SO4, it was deduced that many breakdownrepair and some breakdown-micropitting-repair events occurred in the course of film growth. When 0.01 M Cl ion had been added, the incidence of micropitting beneath the film followed by repair continued for some time before stable pits formed. Models of breakdown and the other processes were proposed with reference to theories of the formation of porous anodic films. It was concluded that the influence of Cl ion in these experiments was exerted in the repair process. At higher Cl ion levels, the stable pits tended to be associated with substrate defects; it was suggested this influence arose in the micropitting process. Author (NSA)

N72-23553# Iowa State Univ. of Science and Technology, Ames.
CHARGING EFFECTS ASSOCIATED WITH OPTICAL EXPERIMENTS AND SURFACE PLASMONS IN METALS Ph.D. Thesis
Arthur James Mansure Nov. 1971 111 p refs
(Contract W-7405-eng-82)
(IS-T-504) Avail: NTIS HC $7.75

The charge density appearing in a semi-infinite electron gas undergoing p-polarized optical excitation is studied as is the charge density associated with a surface plasmon. This investigation is based upon a nonlocal theory for the surface impedance of an electron gas for which the surface electron scattering is specular. Thus the system can be described by nonlocal transverse and longitudinal dielectric functions. Various dielectric functions are incorporated into the study but the results of the self-consistent-field dielectric function are emphasized. For frequencies up to where the surface plasmon dispersion curve stops (2), the charge density accompanying the surface plasmon was found to have essentially the same properties as that of an optical experiment for which the frequency is below the plasma frequency. Author

N72-23554# California Univ., Livermore. Lawrence Radiation Lab.
SOME MECHANICAL PROPERTIES OF ELECTRODEPOSITED LEAD AND LEAD ALLOYS
Harold J. Wiesner 3 Nov. 1971 13 p refs Presented at the Symp. on Properties of Electrodeposited Metals and Alloys for Selected Applications, Columbus, Ohio, 3 Nov. 1971 Sponsored by AEC
(UCRL-73514; Conf-711122-1) Avail: NTIS HC $3.00

Physical and mechanical property data for electrodeposited lead and lead alloys are summarized. The data were compiled for plating from fluoroborate solutions using commercially prepared concentrates of lead, tin, and antimony fluorobotates. It is concluded that these properties match or exceed those obtained from metallurgically prepared materials. F.O.S.

N72-23555# California Univ., Livermore. Lawrence Livermore Lab.
GRAY: A THREE PHASE EQUATION OF STATE FOR METALS
E. B. Royce 3 Sep. 1971 49 p refs
(Contract W-7405-eng-48)
(UCRL-51121) Avail: NTIS HC $4.00

A three-phase equation of state for metals was developed, based on the following assumptions: the entropy of melting is independent of pressure; the temperature dependence of the specific heat in the liquid is a universal curve, scaled on the melting temperature; the pressure dependence of the melting temperature is given by a modified Lindemann law; and the liquid-vapor region may be described by a hard-sphere model perturbed by a van der Waals attraction. The equation of state is laid out in a P(V, E) form for use in numerical hydrodynamics calculations, and parameters are given for Be, Mg, Al, Ti, stainless steel, Ni, Monel, Cu, Nb, Ta, W, Au, Pb, Th, Mulberry, and U. Experimental evidence for the validity of the equation of state is presented. Author (NSA)

N72-23556# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Power Generation Dept.
STUDY OF INTERGRANULAR SEPARATIONS IN LOW ALLOY STEEL HEAT-AFFECTED ZONES UNDER AUSTENITIC STAINLESS STEEL WELD CLADDING
P. S. Ayres, I. Barnes, G. N. Emmanuel, and J. F. Hoosic Dec. 1971 68 p refs
(BAW-10013) Avail: NTIS

Intergranular separations have been detected in the heat-affected zone of SA-508, class 2 material melted to coarse-grain practice. This observation was limited to weld cladding deposited by high heat input processes such as strip, two-wire sereies arc, and six-wire arc cladding. Defects occurred in an area 1/2 inch wide, defined by the A sub 3 boundary of the heat-affected zone of the first bead, and A sub 1 boundary of the heat-affected zone of the second or overlapping bead, and the cladding/base metal interface. The dimensions of these discontinuities were not observed to exceed 0.156 inch in depth and 0.500 inch in length. It was further noted that the grains of the heat-affected zones of the forgings where the intergranular separations occurred, have coarsened to a much greater degree than the comparable heat-affected zone of plate clad by the six-wire arc cladding procedure. McQuaid-Ehn studies indicated that the austenitic grain size of the forgings ranged from 1 to 4, whereas the grain size in plate material varied from 6 to 8. NSA

N72-23557# Sandia Labs., Albuquerque, N.Mex.
STRUCTURE AND MORPHOLOGY OF THIN SPUTTERED NICKEL ALLOY (KOVAR) FILMS AS A FUNCTION OF SUBSTRATE TEMPERATURE
Norman L. Knudsen and Charles Stein (AFWL, Kirtland AFB, N. Mex.) Aug. 1971 42 p refs Sponsored by AEC
(SC-RR-710441) Avail: NTIS

The crystal structure and morphology of thin sputtered Kovar films as a function of deposition temperature were examined by transmission electron microscopy. The films were deposited on thin substrates of 7052 glass to minimize stresses due to cooling (or heating) from deposition temperature to room temperature. Although the bulk form of this alloy has an Ar3 temperature between -80 and -100 C, the metastable BBC alpha phase in the thin films persisted to deposition temperatures up to 500 C. These results were compared with bulk material as well as a film deposited at 18 C which was subsequently heated in the electron microscope. Author (NSA)

N72-23558# Hanford Engineering Development Lab., Richland, Wash.
HIGH STRAIN RATE MECHANICAL PROPERTIES OF TYPE 304 STAINLESS STEEL AND NICKEL 200 (RM-14)
J. M. Steichen Sep. 1971 25 p refs
(Contract AT(45-1)-2170)
(HEDL-TME-71-145) Avail: NTIS

The effect of strain rate on the mechanical properties of solution annealed 304 stainless steel at room temperature and 1000 F and annealed Nickel 200 at room temperature was determined. Strain rates employed in this evaluation ranged from the normal tensile rate to high strain rates associated with hypothetical core disruptive accidents. The results show the deformation behavior of both Nickel 200 at room temperature and 304 stainless steel at room temperature is similar to that of 304 stainless steel at 1000 F; however, the room temperature deformation behavior of Nickel 200 appears to more accurately represent the 1000 F deformation behavior of 304 stainless steel than does the room temperature deformation behavior of 304 stainless steel. Author (NSA)

N72-23559# Hanford Engineering Development Lab., Richland, Wash.
HIGH STRAIN RATE MECHANICAL PROPERTIES OF TYPES 304 AND 316 STAINLESS STEEL (RM-17)
J. M. Steichen Nov. 1971 49 p refs
(HEDL-TME-71-164) Avail: NTIS HC $4.50

The effect of strain rate on the mechanical properties of solution annealed 304 and 20% cold worked 316 stainless steels was determined at temperatures at temperatures from 600 to 1600 F. Stain rates employed in this evaluation ranged from the normal tensile rate to high strain rates associated with incident conditions. The results show the deformation behavior of both materials is significantly influenced by strain rate and that excellent strength and ductility can be expected from both materials in the unirradiated condition at strain rate and temperatures associated with accident conditions. Solution annealed 304 and 20% cold worked 316 stainless steels appear to behave very similarly over the strain rate and temperature range; hence, cold work does not appear to greatly alter the strain rate dependence of austenitic stainless steels.
Author (NSA)

N72-23560# California Univ., Berkeley. Lawrence Radiation Lab. Inorganic Materials Research Div.
PREDICTION OF THE STRESS STRAIN BEHAVIOR OF POLYCRYSTALLINE ALPHA-IRON CONTAINING HARD SPHERICAL PARTICLES Ph.D. Thesis
Russell H. Jones 10 Oct. 1971 99 p refs
(Contract W-7405-eng-48)
(LBL-179) Avail: NTIS

The yielding behavior obeyed a modified Orowan type relationship, as proposed by Ashby. The work hardening rates were in close agreement with the rates predicted by a model based on the generation of secondary dislocations at the particles, also proposed by Ashby. These relationships, which were developed to predict the flow properties of single crystals containing hard particles, were used to predict the flow properties of polycrystals containing hard particles. Alloy with second phase volume fractions of 0.73 to 6.14% and particle diameters of 1250 to 2300 A were examined. The distribution of the particle diameters and randomness of the particle dispersion were examined with carbon extraction replicas. The volume fraction of second phase was determined with the aid of the electron beam microprobe analyzer. The matrix structure was studied using optical and electron transmission microscopy and the grain orientation randomness was examined using the X-ray Laue back reflection technique. Author (NSA)

N72-23561# Addis Translations International, Woodside, Calif.
FORMATION AND REVERSAL OF PREPRECIPITATES IN HARDENED ALUMINUM ALLOYS
Michel Leroy, Jean-Pierre Miraille, and Claude Brichet Jan. 1972 8 p refs Transl. into ENGLISH from Scr. Met (London), v. 5, 1971 p 1111-1116 Prepared for Sandia Labs., Albuquerque
(SC-T-722451) Avail: NTIS

Studies were made of the binary alloys Al-Cu, Al-Mg, and Al-Zn and pseudobinary alloys (Al + Mg2Si). It is shown that the formation of Guinier-Preston zones can only occur if the concentration of the matrix in solution exceeds a limiting value, dependent only on the tempering temperature. The residual concentration of the matrix in solution in the presence of zones, tends toward a second limiting value, which is independent of the initial concentration of the alloy in solution and depends solely on tempering temperature. In the case of most of these alloys, the two limiting values seem to be equal, except for experimental errors. The existence of a limit of solubility of the zones seemed incompatible with a mechanism of random regrouping of the atoms in solution. This incompatibility was shown to be only apparent, since it is kinetic conditions which favor or prevent the formation of the zones. Author

N72-23562# European Atomic Energy Community, Petten (Netherlands). Joint Nuclear Research Center.
BEHAVIOR OF STEELS IN ATMOSPHERES CONTAINING CO AND H2 AND THE EFFECT OF PRETREATMENT AND GASEOUS ADDITIVES
W. Karcher and P. Glaude Aug. 1971 26 p refs
(EUR-4691) Avail: AEC Depository Libraries; EUR FF 4.45

The behavior of various steel materials in gas mixtures containing 0.1 to 1 vol % CO and H2 and approximately 10 vpM of H2O was investigated in the temperature range of 400 to 600 C for periods of exposure up to 2,000 hours under flow conditions. It was found that in these conditions mild steels, with low Cr-content, and ferritic steels tend to form carbon deposits whereas austenitic steels and Ni-based alloys undergo superficial oxidation, the latter causing considerable weight increases in the case of alloys with very high Ni-content. For the low alloyed steels, the effect of pretreatment with phosphoric acid, SO2, silanes, and the influence of the addition of CO2, NH3, N2O, silanes, and SO2 to the flowing gas mixture were studied as well. The results of these experiments suggest a considerable reduction of carbon deposition both by the pretreatment and the injection technique. In both cases, the best results were obtained with SO2 which suppressed carbon deposition completely even if a weighty deposit was formed previously. Good results were observed also with silanes and with a phosphoric acid pretreatment. Author (NSA)

N72-23563# Cornell Univ., Ithaca, N.Y. Materials Science Center.
FAR INFRARED SURFACE RESISTANCE OF A DILUTE CuFe ALLOY
S. R. Derbenwick, G. Brandli, and A. J. Sievers 1971 5 p refs Sponsored in part by ARPA
(Contract at(30-1)-2391)
(NYO-2391-133; MSC-1658) Avail: NTIS

The far infrared surface resistance of a dilute CuFe alloy was measured from 0.6 to 3.0 cm at temperatures from 1.2 K to 50 K and in magnetic fields from 0 to 50 kilogauss at 1.2 K. The measurements were made with a lamellar interferometer coupled to a He-3 cooled bolometer. A special multilayer parallel plate transmission line sample geometry enhanced the weak far infrared absorption by a factor of about 750 and permitted an accurate determination of the frequency-dependent surface resistance. The difference in surface resistance between 4.2 K and 28 K, where the dc resistance minimum occurs, is larger than predicted by skin effect calculations using the measured dc resistivity. A difference in the frequency dependence of the surface resistance at 4.2 K and 49 K, where the dc resistivities are equal was also observed. These results are consistent with the assumption that at temperatures below the Kondo temperature, there is an additional frequency-dependent contribution to the far infrared surface resistance of this CuFe alloy. Author

N72-23564# Oklahoma Univ. Research Inst., Norman.
THERMOELECTRIC SITE EFFECT IN THE NOBLE METALS Progress Report
Ronald R. Bourassa Jan. 1972 16 p refs
(Contract AT(40-1)-3940)
(ORO-3940-3) Avail: NTIS

Results of calculations using Nielsen and Taylor's theory of diffusion thermopower as applied to dilute alloys of Ag, Zn, and Mg in aluminum are reported. These results provide a simple explanation of the previously published experimental data on these alloys. Author

N72-23565# General Electric Co., Lynn, Mass.
TECHNICAL PAPERS OF THE TWENTY-SECOND METALLOGRAPHIC GROUP MEETING
Harriet Roth Roman, comp. Dec. 1971 368 p refs Conf. held at San Diego, Calif., 19-21 Jun. 1968
(Contract AT(29-1)-1106)
(Conf-680614) Avail: NTIS

Articles are presented on radiographic metallography, instruments, test facilities, electron microsopy, microanalytic and other metallographic techniques, alloy metallography, and hygroscopic materials. K.P.D

N72-23566# Hanford Engineering Development Lab., Richland, Wash.
COMPILATION OF DATA AND EMPIRICAL REPRESENTATIONS OF IRRADIATION INDUCED SWELLING OF SOLUTION TREATED TYPES 304 AND 316 STAINLESS STEEL
J. F. Bates and J. L. Straalsund Sep. 1971 24 p refs
(Contract AT(45-1)-2170)
(HEDL-TME-71-139) Avail: NTIS

An empirical equation is provided which describes swelling as a function of irradiation temperature and fluence (E greater than 0.1 MeV). Author (NSA)

N72-23567# California Univ., Livermore. Lawrence Radiation Lab.
USE OF SHOCK WAVES IN THE VAPORIZATION OF METALS
Thomas J. Ahrens and Paul A. Urtiew 5 Aug. 1971 47 p refs

(Contract W-7405-eng-48)
(UCRL-51109) Avail: NTIS

Explosively induced shock waves in aluminum, iron, stronium, lithium, thorium, uranium, and barium are capable of vaporizing appreciable quantities of these metals. When plane shock waves are incident upon porous samples, they will induce vaporization in aluminum, iron, strontium, thorium, and barium. Although Mach stem shocks act on a smaller selective mass of material, they will induce sufficient entropy to vaporize uranium and lithium. When a Mie-Gruneisen equation of state is assumed, it is found that for a given plane explosive system an initial porosity exists that will optimize the shock-induced entropy production in a metal. The optimum initial distention that will result in maximum post-shock entropy is found to vary between 1.6 and 2.0 times the volume of the crystal for several of the metals examined. Author (NSA)

N72-23568# Bhabha Atomic Research Centre, Bombay (India). Chemistry Div.

SET-UP FOR STUDYING ISOTHERMAL AND ISOCHRONAL ANNEALING AFTER COLD WORK AND IRRADIATION OF METALS

B. M. Pande, M. S. Anand, and R. P. Agarwala 1971 13 p refs
(BARC-555) Avail: AEC Depository Libraries

A system for studying isothermal and isochronal annealing of defects introduced in easily oxidizable metals by cold work or irradiation is described. It was standardized by studying the isochronal annealing of cold-worked molybdenum; various annealing stages are discussed. Author (NSA)

N72-23569# Clarkson Coll. of Technology, Potsdam, N.Y.

TRANSPORT AND MAGNETIC PHENOMENA IN CHROMIUM AND IRON ALLOYS, 3 Technical Progress Report, 1 Jan. 1971 - 1 Jan. 1972

Sigurds Arajs Jan. 1972 115 p refs Sponsored by AEC
(COO-3259-1) Avail: NTIS

The electrical resistivity, thermoelectric power, thermal conductivity, and magnetization of different binary chromium and iron alloys over large temperature ranges (4 to 1700 K) were investigated from the viewpoint of their electronic structures and the interactions among elementary excitations in magnetically ordered metallic systems. Although iron and chromium base alloys are technologically important materials, their physical nature is only partially understood. This investigation was directed towards a better understanding of these important metallic systems from a fundamental point of view. Author

N72-23570# Institut Franco-Allemand de Recherches, St. Louis (France).

IMPACT BEHAVIOR OF COPPER RODS PROPAGATING AT 50 TO 1650 m/s ON DIFFERENT METALLIC TARGETS Ph.D. Thesis - Karlsruhe Univ. [DAS VERHALTEN VON KUPFERSTIFTEN BEIM AUFTREFFEN AUF VERCHIEDENE WERKSTOFFE MIT GESCHWINDIGKEITEN ZWISCHEN 50 M/S UND 1650 M/S]

Guenter Weihrauch 24 Mar. 1971 204 p refs In GERMAN
(ISL-7/71) Avail: NTIS HC $12.25

A testing range is described, which enables optical and X-ray high speed photography of plastic deformation and penetration by cylindrical copper projectiles on metallic targets. The impact velocities ranged from 50 m/sec to 250 m/sec. The dynamic yield point of copper is indicated for the target materials, annealed copper, high strength steel, and aluminum oxide for deformation velocities up to 12,000/sec. An increase in yield strength to 0.9 kp.sq mm per 100/sec was observed. The characteristic velocities at which the copper projectile initiates plastic deformation or penetration are determined for the different target materials employed. Author (ESRO)

N72-23571# Maryland Univ., College Park. Engineering Materials Group.

DISCONTINUOUS TWINNING DURING ESSENTIALLY ELASTIC COMPRESSION OF STEEL AT 4.2 K

Murali N. Madhava, Peter J. Worthington, and Ronald W. Armstrong Dec. 1971 12 p refs Submitted for Publication
(Contract N00014-67-A-0239; NR Proj. 031-739)
(AD-736937; EMG-74; TR-4) Avail: NTIS CSCL 11/6

The report gives preliminary results on the compression and tensile testing of SAE 1010 steel at 4.2K. At this temperature, which is far below the ductile-brittle transition temperature, the extended stress-strain behaviour in compression, even to strains on the order of 30%; is totally accounted for by the strain occurring during discontinuous load drops. Otherwise, the specimen exhibits continued elastic loading and unloading. These results are attributed to essentially elastic twinning of the steel whereby the twins and accommodating matrix flow produce a "locked-in" state of deformation. Author (GRA)

N72-23572# Carnegie-Mellon Univ., Pittsburgh, Pa. Mellon Inst. of Science.

A MANUFACTURING PROGRAM FOR THE ELECTROSLAG MELTING AND CASTING OF MATERIALS Final Report, Jul. 1966 - Jan. 1971

G. K. Bhat Jul. 1971 343 p refs
(Contract AF 33(615)-5430)
(AD-736785; AFML-TR-71-162) Avail: NTIS CSCL 11/6

A program to optimize manufacturing parameters of the electroslag remelting and refining process for reliably and reproducibly producing commercial size slab ingots of maraging 300 KSI grade steel and super alloys Rene 41 and Udimet 700 was conducted. Manufacturing techniques for production of small and large solid round and slab ingots of titanium through single electroslag remelting were evaluated. Author (GRA)

N72-23573# Naval Research Lab., Washington, D.C.

FRACTURE EXTENSION RESISTANCE (R CURVE) CHARACTERISTICS FOR THREE HIGH-STRENGTH STEELS Final Report

Ralph W. Judy, Jr. and Robert J. Goode 30 Dec. 1971 19 p refs
(AD-737192; NRL-7361) Avail: NTIS CSCL 11/6

The fracture extension resistance curve (R curve), which delineates the increasing rate of plastic work needed to cause crack propagation in nonbrittle metals, is determined by using Dynamic Tear (DT) test procedures. The resistance parameter is the slope of the R curve. The effect of specimen thickness on the R-curve slope was investigated for three high-strength steels of high, intermediate, and low resistance to ductile fracture. R curves were determined for each steel in the full thickness (1 in.) and for thicknesses of 0.625 and 0.325 in. Author (GRA)

N72-23574# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF ULTRASONIC VIBRATIONS ON THE PHYSICAL PROPERTIES OF METALS DURING TORSION TESTS

V. P. Severdenko and E. I. Boiko 19 Nov. 1971 13 p Transl. into ENGLISH from Vestsi Akad. Navuk Belarusk. SSR, Ser. Fiz.-Tekhn. Navuk (Minsk), no4, 1969 p 82-85
(AF Proj. 6010)
(AD-736908; FTD-MT-24-787-71) Avail: NTIS CSCL 11/6

Results of an experimental study of steel A-12, Brass LS-59 and alloy D-16 undergoing torsion tests on a modernized KM-50-1 machine are described. A monotonic decrease in both the strength and plasticity properties of the materials is observed after a fairly long period of prior exposure to the action of ultrasonic waves and during testing in the course of exposure to ultrasonic waves. During short-term prior exposure of D-16 to ultrasonic waves an increase in the strength and plasticity properties is observed. A subsequent increase in the time of prior exposure to ultrasonic waves leads to softening of the material. Author (GRA)

N72-23575# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATIONS OF ANOMALOUS AUSTENITE-GRAIN GROWTH IN BALL BEARING STEEL
D. Peisker 30 Nov. 1971 15 p refs Transl. into ENGLISH from Freiberger Forschungsh., B., Met. (Berlin), v. 153, 1970 p 95-103
(AF Proj. 7343)
(AD-736898; FTD-HT-23-683-71) Avail: NTIS CSCL 11/6

The anomaly of grain growth was observed in remolten ball bearing steels and in those molten according to standard in the electric-arc furnace. From these tests, the influential factors determining the beginning of secondary recrystallization was derived. From the results conclusion are drawn for remelting with respect to the suppression of secondary recrystallization up to a temperature of austenatization as high as possible.
Author (GRA)

N72-23576# California Univ., Los Angeles. School of Engineering and Applied Science.
APPLICATION OF CORRELATION ANALYSIS TO ACOUSTIC EMISSION
Kanji Ono, Richard Stern, and Marshall Long, Jr. Jan. 1972 25 p refs Presented at the ASTM Symp. on Acoustic Emission, Bal Harbour, Fla., 7 Dec. 1971
(Contract N00014-69-A-0200-4031; NR386700)
(AD-736965; UCLA-ENG-7202) Avail: NTIS CSCL 11/6

Correlation analysis techniques have been used in order to characterize acoustic emission pulses from metals. A brief description of correlation functions and the method of their determination is presented. The time varying spectra of a magnesium sample has been obtained using the present techniques, and then compared with the more common methods of measuring acoustic emission. Other uses of correlation analysis in acoustic emission studies are included. Author (GRA)

N72-23577# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
EFFECT OF MAGNESIUM AS AN ALLOYING ELEMENT IN INCONEL 7
W. H. Couts, Jr. (Wyman-Gordon Co.), S. Inouye, and G. Saul Sep. 1971 65 p refs
(AF Proj. 7351)
(AD-736779; AFML-TR-71-76) Avail: NTIS CSCL 11/6

Six 50-lb heats of Inconel 718 were prepared with magnesium contents ranging from 1 to 350 ppm. Half were vacuum arc remelted and half were arc-remelted under 1/2 atm of argon. The homogenized ingots were extruded and some bar segments were flattened. Upset tests/showed decreased forgeability at the highest Mg content. Hot tensile tests at 1200 F did not show any effect of Mg. Stress rupture tests did show a considerably improved rupture ductility at 1200 F with 30 ppm of Mg and extending up to 200 ppm. The mechanism of this beneficial effect is not clear but it is suspected that Mg may influence the nucleation of Ni3Cb platelets at grain boundaries.
Author (GRA)

N72-23578# Denver Research Inst., Colo.
THE AGING RESPONSE OF SHOCK DEFORMED NICKEL-BASE SUPERALLOYS Final Technical Report, 5 Nov. 1970 - 5 Dec. 1971
R. Norman Orava Jan. 1972 70 p refs
(Contract N00019-71-C-0099)
(AD-737310; DRI-2592) Avail: NTIS CSCL 11/6

An investigation was conducted to study the effect of explosive shock loading on the microstructure and mechanical properties of subsequently age-hardened Udimet 700 nickel-base superalloy. Such shock thermomechanical processing (TMP) has been termed shock-aging. The results of shock TMP, conventional TMP by cold rolling, and thermal processing alone, were compared. U-700 sheet was subjected to a planar plastic shock wave, or rolled to a strain equivalent to the transient shock strain, in each of three initial conditions: solution treated, gamma: aged, or carbide aged. Author (GRA)

N72-23579# Manlabs, Inc., Cambridge, Mass.
EFFECT OF CYCLIC TRANSFORMATION TREATMENTS ON THE STRUCTURE AND MECHANICAL PROPERTIES OF STEELS
S. Andrew Kulin and Konstantin Kreder Oct. 1971 87 p refs
(Contract N00014-70-C-0039; NR Proj. 031-740)
(AD-737262) Avail: NTIS CSCL 13/8

Cyclic transformation experiments have been conducted on three steels. Marked increases in strength properties occur with transformation cycling. This effect then remains constant or decreases somewhat with large numbers of transformation cycling. Ductility and fracture toughness values do not degrade with cyclic strengthening. Prior austenite grain size and martensitic cell lath sizes decrease rapidly to very small values upon cyclic treatment. Also, the number and intensity of dislocation tangles in the cycled martensite increase with such treatments. This type of strengthening, with toughness retention, indicates promise for this method of processing in the achievement of high strength levels in steels. Author (GRA)

N72-23580# Martin Marietta Corp., Denver, Colo.
THE EFFECTS OF SURFACE LAYER ON PLASTIC DEFORMATION AND CRACK PROPAGATION Semiannual Report, Jul. - Dec. 1971
I. R. Kramer and A. Kumar Jan. 1972 22 p refs
(Contract DAAG46-70-C-0102; ARPA Order 180; DA Proj. 7400)
(AD-737276; AMMRC-CR-71-2/3) Avail: NTIS CSCL 11/6

A change in proportional limit after cycling was observed for aluminum 2014-T6. Cycling below the endurance limit increases the proportional limit. The etch pit distribution of dislocations in Fe-3Si steel was investigated. The threshold stress for the appearance of slip steps in untreated and SSLE treated specimens of aluminum 2014-T6 was determined. The percentage of grains deformed in specimens of aluminum 2014-T6 which are stressed to various values was observed. The effect of SSLE treatment on the threshold stress intensity for 4130 steel was established. A diametral gage to measure the surface layer stress of notched specimens was manufactured.
Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N72-23581* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POTASSIUM SILICATE ZINC COATINGS Patent
John B. Schutt, inventor (to NASA) Issued 16 Nov. 1971 4 p Filed 24 Jan. 1968
(NASA-Case-GSC-10361-1; US-Patent-3,620,784; US-Patent-Appl-SN-700040; US-Patent-Class-106-84) Avail: US Patent Office CSCL 11D

A zinc dust formulation is presented for steel and the like, utilizing as a vehicle a potassium silicate solution having a SiO2K2O ratio of about 4.8 to 5.3. The composition is resistant to abrasion and not subject to cracking and crazing during drying; it preferably contains methyltrimethoxysilane to enhance these properties. Official Gazette of the U.S. Patent Office

N72-23582*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A FUNDAMENTAL REVIEW OF THE FRICTION AND WEAR BEHAVIOR OF CERAMICS
Donald H. Buckley 1972 30 p refs Presented at Am. Ceram. Soc. Meeting, Washington, D. C., 8 May 1972

(NASA-TM-X-68046; E-6886) Avail: NTIS HC $3.50 CSCL 11B

The basic concepts associated with the friction and wear of materials are discussed as they relate to ceramics. Properties of ceramics such as crystal structure, crystallographic orientation, mechanical deformation, and surface chemistry are reviewed as they influence friction and wear. Both adhesive and abrasive wear of ceramics are discussed. The friction and wear of ceramics are examined in contact with themselves and when in contact with metals. The influences of environmental constituents such as water and hydrocarbons on friction and wear are reviewed. Materials discussed, by way of example, include aluminum oxide, rutile, calcium fluoride, and lithium fluoride.
Author

N72-23583*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOME IMPORTANT ASPECTS IN TESTING HIGH-MODULUS FIBER COMPOSITE TUBES DESIGNED FOR MULTIAXIAL LOADING
T. L. Sullivan and C. C. Chamis 1972 16 p refs Presented at Conf. on Anal. of Test Methods for High Modulus Fibers and Composites, San Antonio, 12-13 Apr. 1972; sponsored by Am. Soc. for Testing and Mater.
(NASA-TM-X-68045; E-6882) Avail: NTIS HC $3.00 CSCL 11D

Tubular specimens were potted in metal grips to determine the feasibility of this gripping method in applying multiaxial loads. Strain gage rosettes were used to assess grip transitional strains, through thickness strain variation and strain variations along the tube length and circumference. The investigation was limited to loading 0 deg, + or - 45 deg, and 90 deg graphite/epoxy and glass/epoxy tubes in axial tension. Results include modifications made to the grips to reduce transitional strains, illustrations of the tube failure modes, and some material properties. The gripping concept shows promise as a satisfactory technique for applying multiaxial loads to high strength, high modulus fiber composite tubes.
Author

N72-23584*# Avco Corp., Lowell, Mass. Systems Div.
DEFORMATION PROCESSES IN FORGING CERAMICS Progress Report, 8 Jul. - 8 Oct. 1971
R. M. Cannon and W. H. Rhodes 18 Apr. 1972 261 p refs
(NASw-2187)
(NASA-CR-126380; PR-2) Avail: NTIS HC $15.25 CSCL 11B

The deformation processes involved in the forging of refractory ceramic oxides were investigated. A combination of mechanical testing and forging are utilized to investigate both the flow and fracture processes involved. An additional hemisphere forging was done which failed prematurely. Analysis and comparison with available fracture data for AL2O3 indicated possible causes of the failure. Examination of previous forgings indicated an increase in grain boundary cavitation with increasing strain.
Author

N72-23585*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ULTRAVIOLET RADIATION EFFECTS ON THE INFRARED DAMAGE RATE OF A THERMAL CONTROL COATING
James A. Bass Washington May 1972 11 p refs
(NASA-TN-D-6686; G-1055) Avail: NTIS HC $3.00 CSCL 11D

The effects of ultraviolet radiation on the infrared reflectance of ZnO silicone white thermal coatings were investigated. Narrow band ultraviolet radiation for wavelengths in the 2200A to 3500A range by a monochromator and a high pressure, 150-W Eimac xenon lamp. The sample was irradiated while in a vacuum of at least 0.000001 torr, and infrared reflectance was measured in situ with a spectroreflectometer at 19,500A. Reflectance degradation was studied as a function of wavelength, time, intensity, and dose. Damage was wavelength dependent at constant exposure, but no maximum was evident above the shortest wavelength investigated here. The degradation rate at constant intensity was an exponential function of time and varies with intensity.
Author

N72-23586# Lockheed Missiles and Space Co., Palo Alto, Calif.
RESIDUAL STRESSES UNDER PLASMA SPRAYING
A. V. Podzei, I. A. Morozov, and A. M. Virnik [1970] 5 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostro. (Moscow), no. 5, 1969 p 111-115
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Coating depositions on the surface of components whose deformation is constrained always produces residual tensile stresses. These stresses can be reduced by diminishing the temperature of the surface being sprayed, which is achieved by increasing the spraying range or the rate of burner displacement, as well as by cooling the substrate during spraying.
Author

N72-23587# Bendix Corp., Kansas City, Mo.
SPIRAL WRAP: A TECHNIQUE FOR FABRICATING THICK WALL CARBON COMPOSITES
J. W. Steele, J. C. McCoy, and E. R. Frye (Sandia Labs.) Sep. 1971 56 p refs
(Contract AT(29-1)-613)
(BDX-613-433) Avail: NTIS

The application of carbonized resin techniques for producing carbon filament reinforced composites and the development of ply orientations that minimize shrinkage stresses are described. The use of the method enables fabrication of thick walled carbon composite shapes. The process is applicable to a variety of carbon and graphite filaments and test results are reported for several combinations.
Author (NSA)

N72-23588# Bendix Corp., Kansas City, Mo.
CHARACTERIZATION OF FILM ADHESIVES Final Report
K. C. Atkinson Oct. 1971 75 p
(Contract AT(29-1)-613)
(BDX-613-528) Avail: NTIS

The chemical characterization of four film adhesives was performed to select the best adhesive for microcircuits. The tests consisted of: (1) identifying and determining the amount of each component in the system; (2) determining the volatiles, ash content, molecular weight distribution, and epoxy equivalents on both B-staged and cured epoxies; and (3) conducting a thermal analysis.
D.L.G.

N72-23589# Iowa State Univ. of Science and Technology, Ames.
NUCLEAR MAGNETIC RESONANCE STUDY OF THE ANTIFERROMAGNETIC TRANSITION IN MIXED VANADIUM-CHROMIUM DIBORIDES Ph.D. Thesis
Richard Joseph Schoenberger Nov. 1971 102 p refs
(Contract W-7405-eng-82)
(IS-T-485) Avail: NTIS

The observations of the B-11 and V-51 NMR spectra were supplemented by X-ray analysis and magnetic susceptibility measurements. It is concluded that the transition is from a paramagnetic to a magnetically ordered state. Although the system shows the presence of localized moments, the order state appears to involve itinerant rather than localized moments and is believed to be antiferromagnetic by analogy to the dilute-vanadium V-Cr alloy system. Two classes of samples prepared by different methods were studied. The difference in sample preparation was found to have a great effect on certain physical properties of the products.
Author (NSA)

N72-23590# Cornell Univ., Ithaca, N.Y. Materials Science Center.
STUDY OF THE TRANSVERSE MAGNETORESISTANCE OF POLYCRYSTALLINE POTASSIUM Ph.D. Thesis
Haskell Joseph Taub Nov. 1971 114 p refs
(NYO-2150-82) Avail: NTIS

Measurements of the transverse magnetoresistance of polycrystalline potassium below 4.2 K are reported. The dependence of magnetoresistance on sample purity, state of annealing, temperature, and size are discussed in detail. Both helicon and four-terminal measurements show the existence of nonlinear low field behavior. Experimental results are compared with predictions of macroscopic theories of a linear magnetoresistance due to sample geometry and inhomogeneities and with proposals for an intrinsic linear magnetoresistance of potassium. Evidence for electron-phonon Umklapp scattering in the temperature-dependent part of the magnetoresistance is cited. It is concluded that none of the existing theories can adequately account for the temperature-independent part of the linear magnetoresistance. Author

N72-23591# Army Materials and Mechanics Research Center, Watertown, Mass.
STRUCTURAL CHARACTERIZATION OF ISOTACTIC POLYPROPYLENE FILMS OF ULTRAHIGH ORIENTATION. PART 1: DETERMINATION OF CRYSTALLINE AND AMORPHOUS ORIENTATION
C. Richard Desper Sep. 1971 19 p refs
(DA Proj. 1T0-62105-A-329)
(AD-735709; AMMRC-TR-71-37-Pt-1) Avail: NTIS CSCL 11/9

Preferred orientation of the crystalline and amorphous regions in semicrystalline polymers have long been recognized as important factors influencing physical and mechanical behavior. Nearly perfect crystalline orientation was found in a set of four polypropylene films prepared under different stretching conditions by X-ray diffraction. This demonstrates that neither shear nor pressure is essential to the attainment of ultrahigh crystalline orientation. Sonic modulus measurements give values from 0.38 to 0.69 for the amorphous orientation function. The results indicate that certain variations in structure are possible in polymers with ultrahigh crystalline orientation. GRA

N72-23592# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
RADIATION HEAT TRANSFER IN CERAMIC RE-ENTRY HEAT SHIELDS
Joseph Reichman Jan. 1972 40 p refs Presented at 74th Ann. Meeting of the Am. Ceramic Soc., Washington, D. C., 6-11 May 1972
(AD-736931; RE-419J) Avail: NTIS CSCL 11/2

The material parameters commonly used, those of emissivity and the radiative component of thermal conductivity, are examined to determine their validity in characterizing the heat transfer processes in a radiative re-entry heat shield. This is done by comparing calculations of radiative heat fluxes and temperature distributions of two models. The first one uses the standard heat conduction equation employing the above parameters, while the second is based on more exact radiative transfer theory that uses the radiation parameters of the absorption and scattering coefficients. Results of these calculations indicate that for typical aerodynamic heat fluxes calculated temperature distributions for the two models varied significantly, particularly near the surface. Author (GRA)

N72-23593# Army Foreign Science and Technology Center, Charlottesville, Va.
REINFORCED PLASTICS
D. M. Karpinos and V. M. Grosheva 27 Jan. 1972 38 p refs Transl. into ENGLISH from the book "Kompozitsionnye Materially Voloknistogo Stroeniya" Kiev, Izdalelstvo Naukova Dumka, 1970 p 249-271
(AD-737291; FSTC-HT-516-72) Avail: NTIS CSCL 11/9

The fundamental principles of creating reinforced plastics and the many fields of application for this type plastic are presented. Author (GRA)

N72-23594# Illinois Inst. of Tech., Chicago.
CRACK PROPAGATION STUDIES IN GLASSY POLYMERS Final Report, 16 Jun. 1969 - 15 Oct. 1970
Lawrence J. Broutman and Takao Kobayashi Sep. 1971 285 p refs
(Contract DAAG46-69-C-0075; DA Proj. 1F1-62203-A-150)
(AD-736859; AMMRC-CR-71-14) Avail: NTIS CSCL 11/9

The object of this study was to determine the influence of crack velocity on the fracture surface work of glassy polymers. Poly(methyl methacrylate) and polystyrene were studied and it was hypothesized that the fracture surface work as a function of crack velocity could be explained by molecular relaxation behavior. The fracture surface work of rubber modified acrylics has been studied as a function of crack velocity and rubber concentration. A method of crystallizing thick polycarbonate sheets by acetone vapor was developed. The mechanical properties of these sheets were studied as a function of residual acetone content. A micromechanics analysis using finite element methods was performed on rubber modified polymers and the internal stresses were calculated as well as the modulus of elasticity and critical stress for stress whitening as a function of rubber concentration. Author (GRA)

N72-23595# Systems Research Labs., Inc., Dayton, Ohio.
PROPERTIES OF COATINGS AND THIN FILMS FOR PROTECTION AGAINST OXIDATION, CORROSION AND ELECTROMAGNETIC INTERFERENCE Final Report
A. G. Jackson and M. P. Hooker Dec. 1971 107 p refs
(Contract F33615-69-C-1064; AF Proj. 7023)
(AD-736773; ARL-71-0263) Avail: NTIS CSCL 11/3

Work on metal/metal interfaces is reported. Calculations of reflection coefficient for McRae multiple scattering LEED Theory are presented for s-wave case. Kambe's Theory is briefly discussed. A decomposition technique using a Dupont curve resolver is discussed using experimental curves of Nb(110) and of Mo(100). Development of apparatus is outlined. Experimental work presented in detail covers LEED/Auger studies of Al on Mo(110) and Nb(110). Less detailed analysis of other work include Al shell casings, a turbine blade, and fractured samples of D6AC and Ti-6-6-2 alloys. Author (GRA)

N72-23596# Avco Corp., Lowell, Mass. Systems Div.
CARBON REINFORCED COMPOSITE BEARING STRUCTURES Final Report, 1 Apr. 1970 - 1 Sep. 1971
Elliot F. Olster Dec. 1971 130 p refs
(Contract DAAG46-70-C-0040; DA Proj. 1F1-62204-A-170)
(AD-736915; AMMRC-CR-71-13) Avail: NTIS CSCL 11/4

The results of wear tests performed on five types of carbon and graphite fiber compactions and on unidirectionally reinforced composites made using these same fibers in combination with various temperature matrices are presented. The materials were evaluated in a thrust wear tester using a type 4340 steel counterface which was polished to a surface roughness of 16 micrometers in RMS and hardened to 30 Rc. The tests were performed at 40% RH and 70F. Specimen temperature, coefficient of friction and displacement of the steel wear surface were continuously monitored during the tests. In addition limited data is presented on the results of wear tests performed on three dimensionally reinforced graphite/graphite composites and on a radially reinforced graphite/graphite journal bearing. Author (GRA)

N72-23597# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
GLASSY CARBONS Semiannual Progress Report, 1 Jun. - 31 Dec. 1971
Edward E. Hucke Jan. 1972 66 p refs
(Contract DAHC15-71-C-0283; ARPA Order 1824)
(AD-737278) Avail: NTIS CSCL 11/2

The program has three major areas of endeavor, (1) Materials Preparation, (2) Structural Characterization, and (3) Property Evaluation and Correlation. Author (GRA)

N72-23598# Maryland Univ., College Park. Center of Materials Research.
MATERIALS SCIENCE PROGRAM Annual Technical Report,

1 Jul. 1970 - 30 Jun. 1971
30 Jun. 1971 70 p refs
(Contract DAHC15-68-C-0211)
(AD-737280) Avail: NTIS CSCL 14/2

Contents: Electronic and magnetic properties of metals and alloys; High pressure studies and effects; Phase transitions and critical phenomena; Radiation effects on materials; Mechanical properties of materials; Device technology; Synthesis, structure and reactions of materials; Optical and spectroscopy properties of materials. GRA

N72-23599# California Univ., La Jolla. Dept. of the Aerospace and Mechanical Engineering Sciences.

A CONTINUUM THEORY FOR WAVE PROPAGATION IN LAMINATED COMPOSITES

G. A. Hegemier and Adnan H. Nayfeh Sep. 1971 37 p refs
(Grants AF-AFOSR-1957-70; NSF GK-2766; AF Proj. 9782)
(AD-736879; TR-3; AFOSR-72-0030TR) Avail: NTIS CSCL 11/4

A continuum theory is developed for wave propagation normal to the layers of a laminated composite with elastic, periodic microstructure. Construction is based upon an asymptotic scheme in which dominant signal wavelengths are assumed large compared to typical composite micro-dimensions. A hierarchy of models are defined by the order of truncation of the asymptotic sequence obtained. To estimate system accuracy, the phase velocity spectrum is investigated. Retention of all terms in the asymptotic sequence is found to yield the exact spectrum of Rytov. Based upon spectral collation of the lowest order dispersive model, accuracy superior to several existing theories is observed. In addition, treatment of several transient pulse cases show good correlation with exact data. Finally, the lowest order dispersive theory is case in a standard mixture form. Author (GRA)

N72-23600# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

AGGREGATION BEHAVIOR AND FILM FORMATION OF BBL AND OTHER LADDER POLYMERS Technical Report, Apr. 1967 - Mar. 1968

F. E. Arnold and R. L. VanDeusen Aug. 1971 40 p refs
(AF Proj. 7340)
(AD-736777; AFML-TR-71-17) Avail: NTIS CSCL 11/9

The ladder polymer, BBL, has been formed into thin films by collecting suspensions of the polymer obtained from acid reprecipitations upon a fritted glass funnel. After drying, the polymer can be removed in the form of a film with thickness dependent upon the amount of material used. The film can be freely handled and very advantageously used for obtaining infrared spectra. Such a film has a tensile strength of 9,600 lb/sq in as compared to a tensile strength of 16,000 lb/sq in obtained from the same polymer when cast from methanesulfonic acid solution. The films are dark with an intense golden luster which gives the appearance of a metal foil. Other aromatic heterocyclic polymers were examined to compare film formation with molecular structure. Author (GRA)

N72-23601# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

FURTHER STUDY OF UNIDIRECTIONAL AND BIDIRECTIONAL COMPOSITES UNDER CYLINDRICAL BENDING Final Report, Jan. - May 1971

N. J. Pagano and A. S. D. Wang Oct. 1971 76 p refs
(AF Proj. 7340)
(AD-736783; AFML-TR-71-143) Avail: NTIS CSCL 11/4

The results of elasticity solutions for the response of unidirectional and bidirectional laminates are presented in detail and compared to corresponding results given by classical lamination theory. Laminates under uniformly distributed and concentrated loadings are treated. Author (GRA)

N72-23602# Georgia Inst. of Tech., Atlanta. School of Ceramic Engineering.

MELT-GROWN OXIDE METAL COMPOSITES Semiannual Technical Report, 10 Jun. - 9 Dec. 1971

Alan T. Chapman, James F. Benzel, Robert K. Feeney, Reiner J. Gerdes, and John W. Hooper Jan. 1972 132 p refs
(Contract DAAH01-71-C-1046; ARPA Order 1637)
(AD-736929; E18-604-3; SATR-3) Avail: NTIS CSCL 11/4

Research work is underway developing melt-grown oxide-metal composite structures for electron emission testing. The successful development of Y2O3 stabilized HfO2-W as an additional refractory oxide-metal combination suited for composite growth is reported. Experiments using UO2-Ta mixtures produced extensive areas of Ta fiber growth in this oxide. The question of oxide stoichiometry and its influence on composite growth was extensively considered during all phases of composite growth. As a first step in the theoretical analysis of the emission anticipated from the composite structures, the electric potential distribution was determined in the interelectrode gap for several different array geometries. Experimental electron emission current densities of approximately 100 mA/cm2 were routinely achieved, and attempts to exceed this density were limited by the onset of electrical breakdown in the test diode. Author (GRA)

N72-23603# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.

RESEARCH ON STORAGE HEATERS FOR HIGH TEMPERATURE WIND TUNNELS Final Report, Jan. 1964 - Sep. 1971

D. E. Hagford and D. G. DeCoursin Feb. 1972 174 p refs
Prepared in cooperation with Fluidyne Eng. Corp., Minneapolis
(Contracts F40600-68-C-0002; F40600-70-C-0006; AF 40(600)-1094; AF Proj. 3012)
(AD-737367; AEDC-TR-71-258) Avail: NTIS CSCL 11/2

The results from the materials development program for the ceramics of the storage heater system for high temperature wind tunnels are presented. A number of ceramic oxides were evaluated including magnesia, zirconia, and alumina. Magnesia was dropped as a candidate early in the program because of the high vaporization rate experienced in a flowing combustion gas atmosphere. Zirconia was evaluated in its stabilized form using calcia, magnesia, and yttria as the stabilizing oxides. Yttria-stabilized zirconia evolved as the candidate material for the upper portion of the heater matrix (2800 F to 4200 F) and alumina for the lower portion (1000 F to 2800 F). The development program evaluated materials in both subscale and pilot scale tests. The performance of the individual materials during the various subscale tests is discussed. The design basis for a pilot facility is presented along with the material performances following the 85 run, pilot heater test program. Specifications for materials used in the pilot facility are presented along with a cored block specification prepared based on the development program. Author (GRA)

N72-23604# Catholic Univ. of America, Washington, D.C.

DISPLACEMENTS AND FINITE-STRAIN FIELDS IN A SPHERE SUBJECTED TO LARGE DEFORMATIONS Stress Analysis Lab.

A. J. Durelli and T. L. Chen Feb. 1972 40 p refs
(Contract N00014-67-A-0377-0011; CUA Proj. 4.043.051)
(AD-737394; TR-27) Avail: NTIS CSCL 11/10

As part of an extensive investigation on experimental methods to determine displacements, strains and stresses in large deformation problems, this paper presents the three-dimensional solution for displacements and strains for the case of a solid sphere diametrically loaded to several levels of loads. A polyurethane rubber was used to make the sphere, and grids and moire gratings printed on a meridian plane, were used to measure displacements. Strains were obtained by photographical differentiation of the field of displacements. The solution for infinitesimal strains is compared to a previous solution by one of the authors. The maximum applied vertical displacement reduced the diameter of the sphere by 27 percent. Results are presented in terms of Eulerian strains, in the Eulerian description and in terms of natural strains. Author (GRA)

N72-23605# Army Foreign Science and Technology Center, Charlottesville, Va.
POLYMERIZATION FILM-FORMING MATERIALS
V. I. Eliseev 23 Feb. 1972 198 p Transl. into ENGLISH of the book "Polimgrizationnye Plenkoobrazovateli" Moscow, Khimaya Press, 1971 214 p
(AD-737385; FSTC-HT-23-1067-72) Avail: NTIS CSCL 11/3

The book describes methods of production and properties of polymerization film formers, as well as methods of production of coatings based on them. It consists of two sections: the first section discusses problems of the mechanism of production of polymerization film formers and the formation of coatings as well as the aging of polymers and their resistance to various corrosive media; the sevond section presents the characteristics of monomers, the properties of paint and varnish materials and coatings. Author (GRA)

N72-23606# California Univ., San Diego. Dept. of the Aerospace and Mechanical Engineering Sciences.
STRESSES IN LAMINATED COMPOSITES CONTAINING A BROKEN LAYER, PART 2: NUMERICAL RESULTS
Noel E. Ashbaugh Oct. 1971 22 p refs
(Grant AF-AFOSR-1957-70; AF Proj. 9782)
(AD-736876; AFOSR-72-0031TR-PT-2; TR-2) Avail: NTIS CSCL 11/4

The numerical results for the stress distribution in a laminated bimaterial composite containing a crack are presented for different combinations of elastic constituents. The crack is the result of a broken layer in an externally loaded composite. A method which may have general application is used to reduce a singular differential-integral equation to a tractable form for computations. The stress intensity factor associated with the in-plane extension of the crack is shown for various combinations of constituents. Estimates of the stress intensity factor which may be obtained without extensive numerical computation are also discussed. GRA

N72-23607# Naval Civil Engineering Lab., Port Hueneme, Calif.
WINDOWS FOR EXTERNAL OR INTERNAL HYDROSTATIC PRESSURE VESSELS. PART 6: CONICAL ACRYLIC WINDOWS UNDER LONG-TERM PRESSURE APPLICATION AT 5,000 PSI Technical Report, Mar. 1969 - Oct. 1970
J. D. Stachiw and K. O. Gray Nov. 1971 65 p refs
(YF51543008)
(AD-736594; NCEL-TR-747) Avail: NTIS CSCL 11/9

Conical acrylic windows with five included angles (alpha) from 30 to 150 degrees and thickness-to-minor-diameter (t/D) ratios from 0.375 to 1.00 have been subjected to 5,000 psi of sustained hydrostatic loading for up to 1,000 hours in the temperature range from 65 F to 75 F while the axial displacement of the windows through the flange has been monitored. The magnitude of axial displacement was found to be a function of alpha, t/D ratio, temperature, and duration of loading. Only windows with t/D ratios greater than or equal to 1.000, 0.625, 0.500, 0.500, and 0.500 for 30-, 60-, 90-, 120-, and 150-degree conical angles, respectively, were found to be free of cracks.
Author (GRA)

N72-23608# California Univ., La Jolla. Dept. of the Aerospace and Mechanical Engineering Sciences.
STRESSES IN LAMINATED COMPOSITES CONTAINING A BROKEN LAYER. PART 1: ANALYSIS
Noel F. Ashbaugh Oct. 1971 31 p refs
(Grant AF-AFOSR-1957-70; AF Proj. 9782)
(AD-736834; AFOSR-72-0032-TR; TR-Pt-1; TR-1) Avail: NTIS CSCL 11/4

The stress field around a stress-free crack in bimaterial laminated composite with elastic constituents is determined when the external loads open the crack surfaces. The crack is created by a broken layer and has a finite length. This problem is reduced to one in which the only nonzero boundary stress is a normal stress on the crack surface. However the solution presented in this paper applied to a more general problem where either the normal displacement or the normal stress can be prescribed. The stresses are given by integral expressions which contain the derivative of the normal displacement along the crack surface. Author (GRA)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N72-23609 Kentucky Univ., Lexington.
A GENERAL SOLUTION TO THE FIRST ORDER EQUATIONS OF MOTION FOR THE MAXWELL RINGLET PLUS SATELLITE MODEL AND ITS APPLICATION TO SATURN'S RINGS Ph.D. Thesis
Bartlett Graves Dickinson 1970 136 p
Avail: Univ. Microfilms Order No. 71-19363

The model used to investigate the relationship between Saturn's rings and its moons consists of a circle of p nearly evenly spaced particles concentric to Saturn, and a moon which also revolves about Saturn in an approximate circle. The model without the moon is known as a Maxwell ringlet. This problem is again solved here using Lagrangian mechanics and a set of quasinormal coordinates. When the moon is added to the system, the first order equations of motion become a set of 2p simultaneous, linear, second order, inhomogeneous differential equations with trigonometric coefficients, which are simplified but no longer separated by the quasi-normal coordinates. A general solution in terms of series of trigonometric functions is found which reduces the differential equations to a solvable set of linear algebraic equations. Dissert. Abstr.

N72-23610 Stanford Univ., Calif.
LINEAR PURSUIT-EVASION GAMES AND THE ISOTROPIC ROCKET Ph.D. Thesis
Pierre Bernhard 1971 175 p
Avail: Univ. Microfilms Order No. 71-19650

The direct method of Pontryagin, specifically dealing with linear pursuit-evasion games, is presented and discussed. It is shown how it applies to several information structures. The phenomenon that can prevent these strategies from being globally optimal is described, providing criteria to check this optimality. An analysis is given of Pshenichnyi's non-regular points, linking them with the abnormal problem of the calculus of variations and with Isaacs' concept of a barrier. Pontryagin's technique is also applied to multistage games, the main emphasis being on a system-theoretic formulation where the controls are unbounded and the capture set is a subspace. Explicit criteria are given for completion to be possible with the three main information structures. Following Kalman, special attention is given to the case where the capture subspace is a submodule of the system. An investigation of specific examples: Isaacs' isotopic rocket, the game of kind where the payoff is capture or escape, and the game of degree where the payoff is the time of capture is reported. Dissert. Abstr.

N72-23611*# Scripta Technica, Inc., Washington, D.C.
NUMERICAL METHODS FOR SOLVING PROBLEMS OF MECHANICS OF CONTINUOUS MEDIA
O. M. Belotserkovskiy, ed. NASA May 1972 215 p refs Transl. into ENGLISH of the book "Chislennye Metody Resheniya Zadach Mekhaniki Sploshnykh Sred" Moscow, Acad. of Sci., 1969 p 1-229
(Contract NASw-2036)
(NASA-TT-F-667) Avail: NTIS HC $3.00 CSCL 12A

Numerical analysis and methods are discussed for problems of gas dynamics. The methods considered include the method of characteristics, finite difference theory, and the method of integral relations. For individual titles, see N72-23612 through N72-23617.

N72-23612*# Scripta Technica, Inc., Washington, D.C.
DIFFERENCE METHODS IN SOLVING PROBLEMS OF GAS DYNAMICS c12
V. V. Rusanov *In its* Numerical Methods for Solving Probl. of Mech. of Continuous Media May 1972 p 5-34 refs (See N72-23611 14-19)
Avail: NTIS HC $3.00 CSCL 20D

Both steady state and nonstationary problems of gas flow are vonsidered. An example is presented for supersonic gas flow around a blunt body. A description is given of the difference method applied to the solution of two-dimensional problems of flows past bodies. The problem of calculation of flow in the supersonic region is discussed. K.P.D.

N72-23613*# Scripta Technica, Inc., Washington, D.C.
METHODS OF SOLVING UNSTEADY PROBLEMS OF GAS DYNAMICS c12
B. F. Dyachenko *In its* Numerical Methods for Solving Probl. of Mech. of Continuous Media May 1972 p 35-59 refs (See N72-23611 14-19)
Avail: NTIS HC $3.00 CSCL 20D

Equations of state are given for a continuous medium, and the method of characteristics is considered in relation to gas dynamics. Discontinuous solutions to the gas dynamic equations and the break-up of an arbitrary discontinuity are discussed. Smoothing of shock waves, and implicit and two-dimensional schemes, are also considered. K.P.D.

N72-23614*# Scripta Technica, Inc., Washington, D.C.
THE DECOMPOSITION METHOD IN SOLVING PROBLEMS OF MATHEMATICAL PHYSICS
G. I. Marchuk *In its* Numerical Methods for Solving Probl. of Mech. of Continuous Media May 1972 p 61-79 refs (See N72-2361.1 14-19)
Avail: NTIS HC $3.00 CSCL 12A

Decomposition methods for weak approximation are discussed in relation to steady state gas dynamics. These involve constructing schemes with a decomposable (factored) upper operator for parabolic- and hyperbolic-type equations. Methods of separation and the predictor-corrector method for nonstationary problems are considered. Methods of dealing with operators with arbitary structure or with imaginary values as spectral points are presented. Problems in dynamic meteorology are also discussed. In addition, methods of solving problems when the operator of the steady state problem is not positively defined are given. K.P.D.

N72-23615*# Scripta Technica, Inc., Washington, D.C.
THE USE OF THE METHOD OF THE SMALL PARAMETER FOR NUMERICAL SOLUTION OF EQUATIONS OF MATHEMATICAL PHYSICS
A. A. Dorodnitsyn *In its* Numerical Methods for Solving Probl. of Mech. of Continuous Media May 1972 p 80-96 (See N72-23611 14-19)
Avail: NTIS HC $3.00 CSCL 12A

The small parameter method is discussed with regard to problems of perturbation theory. The classical nonlinear problem is vonsidered for the Laplace equation; the example is that of conformal mapping of a region into a circle of unit radius. K.P.D.

N72-23616*# Scripta Technica, Inc., Washington, D.C.
NUMERICAL METHODS IN SOLVING STEADY-STATE EQUATIONS OF GAS DYNAMICS c12
O. M. Belotserkovskiy *In its* Numerical Methods for Solving Probl. of Mech. of Continuous Media May 1972 p 97-195 refs (See N72-23611 14-19)
Avail: NTIS HC $3.00 CSCL 20D

The methods of finite differences, integral relations, and characteristics are discussed for solving steady state gas dynamic equations. Problems of symmetric flow about bodies moving at the speed of sound and flow in the boundary layer are considered using the method of integral relations. Two-dimensional characteristics in nonequilibrium flows and elementary problems are analyzed using the method of characteristics. Three-dimensional characteristics and the quasi-characteristic method are also considered. Calculation of the flow around blunt bodies with a detached shock wave is reviewed. In this regard, algorithms are given for numerical schemes using the method of integral relations for computing mixed gas flows, as well as a scheme using the method of straight lines for calculating supersonic flows. The use of pseudoviscosity is examined in the numerical solution of the inverse problem of gas dynamics. K.P.D.

N72-23617*# Scripta Technica, Inc., Washington, D.C.
CERTAIN NUMERICAL METHODS FOR SOLVING EQUATIONS OF THE BOUNDARY LAYER c12
V. V. Shchennikov *In its* Numerical Methods for Solving Probl. of Mech. of Continuous Media May 1972 p 196-211 refs (See N72-23611 14-19)
Avail: NTIS HC $3.00 CSCL 20D

The generalized method of integral relations and the method of finite differences are analyzed in relation to solving boundary layer equations. Several schemes and systems of equations for first, second, and third approximations are given. K.P.D.

N72-23618# Joint Publications Research Service, Arlington, Va.
DIFFERENTIAL GAMES
26 Apr. 1972 13 p Transl. into ENGLISH from Dokl. Acad. Nauk SSSR (Moscow), v. 273, no. 1, 1972 p 32-35 and 46-49 (JPRS-55808) Avail: NTIS HC $3.00

Minimax absorption in differential-difference games and differential games with variable amounts of information are discussed. For individual titles, see N72-23619 through N72-23620.

N72-23619# Joint Publications Research Service, Arlington, Va.
MINIMAX ABSORPTION IN DIFFERENTIAL-DIFFERENCE GAMES
Yu. S. Osipov *In its* Differential Games 26 Apr. 1972 p 1-5 (See N72-23618 14-19)
Avail: NTIS HC $3.00

The sufficient conditions of successful completion of a differential-difference rendezvous game are presented. The structure of the extremal rendezvous strategies is explained. The basis for the argument is the concept of minimax programmed absorption which is modified for application to this class of problems. Author

N72-23620# Joint Publications Research Service, Arlington, Va.
DIFFERENTIAL GAMES WITH VARIABLE CONDITIONS OF BEING INFORMED
A. A. Melikyan and F. L. Chernousko *In its* Differential Games 26 Apr. 1972 p 6-11 (See N72-23618 14-19)
Avail: NTIS HC $3.00

In the theory of differential games it is usually assumed that the phase coordinates of both sides are exactly known to each player at any point in time. However, in applied problems the informed nature of the sides is nonideal. The present study was made of games in which one of the sides can measure the phase coordinates of the other side only in part of the interval of motion. Author

N72-23621*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROOTS OF POLYNOMIALS BY RATIO OF SUCCESSIVE DERIVATIVES
James E. Crouse and Charles W. Putt Washington May 1972 81 p refs
(NASA-TN-D-6793; E-6585) Avail: NTIS HC $3.00 CSCL 12A

An order of magnitude study of the ratios of successive polynomial derivatives yields information about the number of

roots at an approached root point and the approximate location of a root point from a nearby point. The location approximation improves as a root is approached, so a powerful convergence procedure becomes available. These principles are developed into a computer program which finds the roots of polynomials with real number coefficients. Author

N72-23622# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
CYCLIC DESIGNS
J. A. John (Southampton Univ.), F. W. Wolock (Southeastern Mass. Univ.), H. A. David (North Carolina Univ., Chapel Hill), J. M. Cameron, and J. A. Speckman Apr. 1972 82 p refs Sponsored in part by AROD
(NBS-AMS-62; LC-72-183999) Avail: SOD $0.75 as C 13.32:62

Cyclic designs are incomplete block designs based on cyclic development of an initial block or blocks. Their flexibility, ease in conduct of the experiment and natural grouping for elimination of heterogeneity make them worthy of attention in their own right even though their analysis does not possess the ease of computation of the more common completely balanced or partially balanced incomplete block designs with two associate classes. Methods for construction and analysis of the designs are given along with a numerical example. Applications of the designs are discussed and an appendix on their use in calibration is given. Author

N72-23623# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON UTILIZATION OF THE INTEGRAL RELATIONS METHODS TO CONSTRUCT MESH SCHEMES IN THE POISSON EQUATION CASE
A. V. Samusenko 1972 4 p refs Transl. into ENGLISH from Izv. Akad. Nauk Belorussk. SSR, Ser. Fiz. Mat. Nauk (Minsk) no. 1, 1972 p 81-85
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Mesh, or difference, schemes dependent on parameters are constructed using the method of integral relations for solving partial differential equations. By giving definite numerical values to the parameters specific computational schemes are obtained every time. The domain of parameter variation can be determined, for example, by convergence and stability conditions for the difference schemes. Author

N72-23624# Minnesota Univ., Minneapolis.
FREDHOLM RESOLVENT IN THE OPTIMIZATION OF LINEAR SYSTEMS WITH STATE AND CONTROL RETARDATIONS Ph.D. Thesis.
Heikki Niilo Koivo Dec. 1971 132 p refs
(Grant AF-AFOSR-1502-68; AF Proj. 9769)
(AD-736949; AFOSR-72-0332TR) Avail: NTIS CSCL 12/1

Basically, the report has extended results obtained for linear time delay systems with quadratic cost. The Fredholm resolvent theory was shown to be a versatile tool in solving quadratic control problems with time delay system constraints.
Author (GRA)

N72-23625# Washington Univ., St. Louis, Mo.
OBSERVABILITY OF NONLINEAR SYSTEMS
Shauying R. Kou, David L. Elliott, and Tzyh-Jong Tarn 15 Dec. 1971 20 p refs
(Contract F44620-69-C-0116; Grants NSF GK-5570; NSF GK-27873; NSF GK-229-05; AF Proj. 7921)
(AD-736800; CSSE-729; AFOSR-72-0310TR) Avail: NTIS CSCL 12/1

The purpose of the paper is to investigate the problem of observability of nonlinear systems. Two sufficient conditions of global observability of nonlinear systems are presented: (1) the ratio condition which is the generalization of Fujisawa and Kuh's ratio condition of circuit theory, (2) the strongly positive semidefinite condition. The relationships between these two conditions as well as the condition of positive definiteness of Fitts are given. Author (GRA)

N72-23626# Washington Univ., St. Louis, Mo. Control Systems Science and Engineering.
BOUNDS ON THE ACCURACY IN CAUSAL FILTERING FOR NONLINEAR OBSERVATIONS WITH SOME IMPLICATIONS ON ASYMPTOTIC SEPARATION IN STOCHASTIC CONTROL Interim Report
Donald L. Snyder and Ian B. Rhodes 30 Jun. 1971 15 p refs Sponsored in part by NIH
(Contract F44620-69-C-0116; AF Proj. 7921)
(AD-736799; CSSE-719; AFOSR-72-0309TR) Avail: NTIS CSCL 12/1

A bound is derived on the accuracy in causally estimating a Gaussian process from nonlinear observations. Both additive Gaussian noise and Poisson observations are included. The bound is used to study the control of a stochastic linear dynamical system with nonlinear observations and an average quadratic cost. An asymptotic separation theorem is established showing that a linear feedback control law, involving a state estimate, is asymptotically optimum as the accuracy of the state estimate approaches the bound. Author (GRA)

N72-23627# Army Missile Command, Redstone Arsenal, Ala. Aeroballistics Directorate.
FREQUENT MISCONCEPTIONS FROM THE USE OF CONFIDENCE STATEMENTS AS THE LONE CONSIDERATION IN RELIABILITY REQUIREMENTS
Raymond H. Myers and Nancy R. Rich Nov. 1971 17 p
(DA Proj. 1x263302-D-212)
(AD-737196; RD-TR-71-26) Avail: NTIS CSCL 12/1

The report presents a discussion of the disadvantages of the use of such phrasing as 'the system must demonstrate 95 percent reliability with 90 percent confidence' when the required reliability for the system is 95 percent. Several examples are offered to illustrate how such wording can be misleading. A brief summary of elementary estimation theory is presented. The recommendation is given that such phrases as '95 percent reliability with 90 percent confidence' be stricken from all Army documents. Author (GRA)

N72-23628# Washington Univ., St. Louis, Mo. Control Systems Science and Engineering.
PRACTICAL NONLINEAR FILTERING OF DISCRETE OBSERVATIONS BY GENERALIZED LEAST SQUARES APPROXIMATION OF THE CONDITIONAL PROBABILITY DISTRIBUTION
Julian L. Center, Jr. 20 Oct. 1971 14 p refs
(Contract F44620-69-C-0116; Grants NSF GK-22905; NSF GK-4394; AF Proj. 7921)
(AD-736782; CSSE-724; AFOSR-72-0315TR) Avail: NTIS CSCL 12/1

The requirements for practical implementation of recursive filtering algorithms are discussed. A generalization of standard least squares approximation was used as tool for designing such algorithms. Author

N72-23629# Illinois Univ., Urbana. Coordinated Science Lab.
REDUCED ORDER SENSITIVITY MODELS OF LINEAR SYSTEMS WITH APPLICATIONS Ph.D. Thesis
Raj Kumar Varshney Jan. 1972 214 p refs Sponsored in part by the Ford Found.
(Contract DAAB07-67-C-0199; Grant AF-AFOSR-1579-68)
(AD-737162; R-545; UILU-ENG-72-2204) Avail: NTIS CSCL 12/1

The study is directed towards developing reduced-order parameter and initial condition sensitivity models for linear time-invariant continuous-time, sampled-data and time-delay systems. By introducing the concept of companion relationship among sensitivity functions, it is established that the sensitivity system as a general cyclic continuous-time system has the same

dimensions whether the system is represented in companion form or in phase-variable form. Computational aspects for attaining higher accuracy and greater efficiency in sensitivity realization are discussed. For systems with real eigenvalues, it is shown that its sensitivity system can be realized efficiently using Jordan canonic form. Generation of input parameter sensitivity functions is studied and reduced-order models for two classes of input functions are developed. Author (GRA)

N72-23630# Naval Weapons Center, China Lake, Calif.
FORTRAN PROGRAMS TO SOLVE THE STEADY STATE MATRIX RICCATI EQUATIONS ARISING IN KALMAN FILTERING THEORY
L. W. Lucas and G. A. Hewer Dec. 1971 58 p refs
(AD-736921; NWC-TP-5180) Avail: NTIS CSCL 12/1

The report describes a package of FORTRAN programs to solve the continuous and discrete matrix Riccati equations which arise in optimal filtering theory. A quasi-linearization algorithm is employed which is quadratically convergent. Author (GRA)

N72-23631# Washington Univ., St. Louis, Mo.
CONTROLLABILITY AND OBSERVABILITY FOR BILINEAR SYSTEMS
David L. Elliott and Tzyh-Jong Tarn 15 Jul. 1971 10 p
(Contract F44620-69-C-0116; Grants NSF GK-27873; NSF GK-5570; AF Proj. 7921)
(AD-736808; CSSE-722; AFOSR-72-0355TR) Avail: NTIS CSCL 12/1

Controllability and observability are discussed for control systems of the form (*)dx/dt = (u(t)A + v(t)B)x, where u, v are piecewise constant controls. Let L be the Lie algebra generated by matrices A, B; let G be the connected matrix Lie group determined by L; it is proved that G is the set of fundamental matrix solutions of (*), so that controllability of (*) is equivalent to the transitivity of G on the appropriate state space (n-space punctured at the origin). A list of such transitive groups is conjectured. Author (GRA)

N72-23632# Washington Univ., St. Louis, Mo. Control Systems Science and Engineering.
ON THE CONTROLLABILITY OF A CLASS OF DISCRETE BILINEAR SYSTEMS Interim Report
Tsuyoshi Goka, Izyh-Jong Tarn, and John Zaborszky 15 Dec. 1971 22 p refs
(Contract F44620-69-C-0116; Grants NSF GK-22905; NSF GK-5570; AF PROJ. 7921)
(AD-736802; CSSE-727; AFOSR-72-0312TR) Avail: NTIS CSCL 12/1

The subject of the paper is the controllability of a class of autonomous discrete bilinear systems. Bilinear systems are classified into two categories; homogeneous and inhomogeneous. The necessity as well as the sufficiency results are obtained by means of decomposing the bilinear system into a linear system and a multiplicative feedback. By-products of the decomposition are the notions of multiplicative feedback compensation and the multiplicative feedback with bias compensation which may prove to be alternatives for the classical linear feedback compensation. Author (GRA)

N72-23633# Washington Univ., St. Louis, Mo. Control Systems Science and Engineering.
ON THE CONTROLLABILITY OF DISCRETE BILINEAR SYSTEMS Interim Report
Tsuyoshi Goka, Tzyh-Jong Tarn, and David L. Elliott Dec. 1971 19 p refs
(Contract F44620-69-C-0116; Grants NSF GK-5570; NSF GK-27873; NSF GK-22905; AF Proj. 7921)
(AD-736803; CSSE-728; AFOSR-72-0313TR) Avail: NTIS CSCL 12/1

The subject of the paper is the controllability of discrete-time bilinear systems. Bilinear systems are classified into two categories: homogeneous and inhomogeneous. Sufficient conditions which ensure the global controllability of bilinear systems are obtained by localized analysis in control variables. Author (GRA)

N72-23634# Washington Univ., St. Louis, Mo.
A NOTE ON THE SEPARATION THEOREMS FOR LINEAR STOCHASTIC SYSTEMS AND QUADRATIC COSTS
Ian B. Rhodes 4 Aug. 1971 12 p refs
(Contract F44620-69-C-0116; AF Proj. 7921)
(AD-736805; CSSE-721; AFOSR-72-0319TR) Avail: NTIS CSCL 12/1

Direct proofs are presented for the two separation theorems involving linear systems and quadratic cost functionals. The first is for the case when all random vectors are jointly Gaussian and the cost functional is minimized over all control laws whose value at each time is restricted only to being a finite-variance measurable function of the output history of the system up to that time. The second does not require that all random vectors be Gaussian but restricts attention to control laws that at each time are linear functions of the past output history. Author (GRA)

N72-23635# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
ESTIMATION OF THE COVARIANCE PARAMETERS OF NON-STATIONARY TIME-DISCRETE LINEAR SYSTEMS Research Report, Sep. 1970 - Sep 1971
Patrick L. Smith 30 Sep. 1971 30 p refs
(Contract F04701-71-C-0172)
(AD-736817; TR-0172(2311)-3; SAMSO-TR-72-18) Avail: NTIS CSCL 12/1

The Kalman filter sequentially generates the minimum variance estimate of the state of a linear dynamic system. This estimate is a function of the covariance parameters of the dynamic system model which implies that these be known a priori. Unfortunately some or all these covariance parameters are often unknown in engineering applications of the Kalman filter. In the report the maximum-likelihood estimates of the unknown covariance parameters of a time-discrete nonstationary linear system are computed from measurement residuals of a suboptimal sequential filter. Results for nonstationary linear systems are useful for nonlinear systems because most nonlinear estimation problems are solved by linearization which results in linear nonstationary plant and measurement models. Author (GRA)

N72-23636# Utah Univ., Salt Lake City. Dept. of Mathematics.
A LOCAL COMPACTNESS THEOREM FOR WAVE PROPAGATION PROBLEMS OF CLASSICAL PHYSICS Technical Summary Report
John R. Schulenberger Nov. 1971 13 p refs
(Contract N00014-67-A-0325-0006; NR Proj. 041-370)
(AD-737344; TSR-15) Avail: NTIS CSCL 12/1

Many of the wave propagation problems of classical physics can be formulated as symmetric hyperbolic differential equations of the form: i partial derivative(sub t) = Lambda (D)u = -iE(sup -1) summation j = 1 to n of A(sup j) partial derivative(sub j)u where Lambda (D) is an operator of constant deficit and generates a self-adjoint operator Lambda in the Hilbert space H consisting of functions f,g epsilon L(sub 2) (R sup n) sup m with inner product <f,g> = (f,Eg). It is shown that a set (u) of functions in the domain of Lambda, which is orthogonal to the nullspace of Lambda and is bounded in graph norm, is precompact in H(loc), provided that E is bounded, measurable, and uniformly positive-definite. If Lambda(sub 0) is the corresponding operator in H(sub 0) generated by Lambda(sub 0) (D) of the same form as Lambda (D) but with constant coefficients, then this result implies that the wave operators W(sub + or -) (Lambda, Lambda (sub 0)) exist and are complete. This applies, in particular, to the propagation of waves through a lens, crystals, etc. where the functions describing the properties of the medium have jump discontinuities. Author

N72-23396*# Scripta Technica, Inc., Washington, D.C.
ON THE RESOLUTION OF THE STANDARD ALGORITHM FOR COSMIC RAY STATIONS
I. A. Pimenov *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 95-98 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 12A

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N72-23637*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SURFACE ATMOSPHERIC EXTREMES (LAUNCH AND TRANSPORTATION AREAS) NASA Space Vehicle Design Criteria (Environment)
May 1972 59 p refs
(NASA-SP-8084) Avail: NTIS HC $3.00 CSCL 04B

The effects of extreme values of surface and low altitude atmospheric parameters on space vehicle design, tests, and operations are discussed. Atmospheric extremes from the surface to 150 meters for geographic locations of interest to NASA are given. Thermal parameters (temperature and solar radiation), humidity, pressure, and atmospheric electricity (lighting and static) are presented. Weather charts and tables are included.
Author

N72-23638*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AIR-SEA INTERACTION IN THE TROPICAL PACIFIC OCEAN
Lewis J. Allison, Joseph Steranka, Robert J. Holub, John Hansen, Fredric A. Godshall, and Cuddapah Prabhakara Washington May 1972 86 p refs
(NASA-TN-D-6684; G-1042) Avail: NTIS HC $3.00 CSCL 04B

Charts of 3-month sea surface temperature (SST) anomalies in the eastern tropical Pacific Ocean were produced for the period 1949 to 1970. The anomalies along the United States and South American west coasts and in the eastern tropical Pacific appeared to be oscillating in phase during this period. Similarly, the satellite-derived cloudiness for each of four quadrants of the Pacific Ocean (130 deg E to 100 deg W, 30 deg N to 25 deg S) appeared to be oscillating in phase. In addition, a global tropical cloudiness oscillation from 30 deg N to 30 deg S was noted from 1965 to 1970, by using monthly satellite television nephanalyses. The SST anomalies were found to have a good degree of correlation both positive and negative with the following monthly geophysical parameters: (1) satellite-derived cloudiness, (2) strength of the North and South Pacific semipermanent anticyclones, (3) tropical Pacific island rainfall, and (4) Darwin surface pressure. Several strong direct local and crossequatorial relationships were noted. In particular, the high degree of correlation between the tropical island rainfall and the SST anomalies ($r = +0.93$) permitted the derivation of SST's for the tropical Pacific back to 1905. The close occurrence of cold tropical SST and North Pacific 700-mb positive height anomalies with central United States drought conditions was noted.
Author

N72-23639# Lockheed Missiles and Space Co., Palo Alto, Calif.
INTERRELATION BETWEEN THE DEVELOPMENT OF SYNOPTIC PROCESSES AND THE EVOLUTION OF AN INTEGRATED HUMIDITY FIELD BY SATELLITE MEASUREMENTS
E. P. Dombkovskaia and V. V. Demin [1972] 8 p refs Transl. into ENGLISH from Tr. Gidrometeo. Nauchno-Issled. Tsentr. SSSR, no. 73, 1971 p 134-142
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The possibility of a synoptic representation of data on the total moisture content of the atmosphere obtained from satellite data are discussed and illustrations of the synoptic interpretation of these data are described. A relationship between various synoptic formations and elements of the field w is established along with the interrelationship between the synoptic process development and the changes in the integrated humidity field corresponding to this development. Data cover altitude and turbidity analysis charts, daily weather bulletins of Great Britain, and radiosonde data from 9 weather ships in the North Atlantic. Weather maps are included.
Author

N72-23640# Lockheed Missiles and Space Co., Palo Alto, Calif.
ESTIMATE OF THE CHARACTERISTICS OF A VERTICAL HUMIDITY DISTRIBUTION IN THE ATMOSPHERE BY MEANS OF SATELLITE MEASUREMENTS
V. G. Boldyrev, A. S. Gurvich, E. P. Dombkovskaia, and T. G. Krasilnikova [1972] 7 p refs Transl. into ENGLISH from Tr. Gidrometeorolog. Naucho-Issled. Tsentr. SSSR (Leningrad), no. 73, 1971 p 126-133
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The determination of the vertical distribution of the specific humidity over oceans from satellite measurements of the integrated water vapor distribution is described. The statistical characteristics of the humidity as a function of latitude, atmospheric circulation, and season of the year are considered. Measurements performed on Cosmos 243, for which there were radiosonde results, were taken for an experimental verification of the method of determining moisture content. It is concluded that satellite measurements of the integrated humidity can yield the vertical humidity distribution.
N.E.N.

N72-23641# Los Alamos Scientific Lab., N.Mex.
COMPILATION AND STUDY OF METEOROLOGICAL DATA FOR LOS ALAMOS, NEW MEXICO, 1956 - 1970
E. G. Arntzen and W. R. Foley Dec. 1971 118 p
(Contract W-7405-eng-36)
(LA-4790) Avail: NTIS HC $8.00

These data include the hourly dry bulb temperatures; relative humidity; wet bulb temperatures for hours when the dry bulb temperature are 55 F., or greater; humidity ratio; and enthalpy. These data were used to verify the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Weather Data and Design Conditions for Los Alamos. The winter design temperatures agreed very closely, but the ASHRAE summer dry bulb and wet bulb design temperatures were both high and, therefore, more conservative. The data indicate that the following are more nearly representative design temperatures for Los Alamos. Winter, dry bulb: 3 F(99); 8 F(97 1/2%), summer, dry bulb: 85.3 F(1%); 82.9 F(2 1/2%); 80.5 F(5%), and summer, wet bulb: 63.2 F(1%); 61.7 F(2 1/2%); 60.5 F (5%). These values are the temperatures above which the temperature was observed to be the percent of the time given.
Author (NSA)

N72-23642# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
METEOROLOGICAL YEARBOOK (12TH), 1970
G. Bollini and C. Gandino 1971 89 p
(EUR-4710) Avail: AEC Depository Libraries; EUR Lit. 1560.

The methods for measuring and describing atmospheric phenomena are presented, including many tables and graphics for the meteorological year 1970. With the observatory's data, temperature measurements at screen No. 4, 45 meters lower, the flow of the Novellino brook and the wind data, at the 120 meter level of the meteorological tower are added.
Author (NSA)

N72-23643# Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany). Physikalisch-Bioklimatische Forschungsstelle.
MEASUREMENT OF AIRBORNE RADIOACTIVITY AND ITS METEOROLOGICAL APPLICATION, PART 2 Annual Report, 1 Apr. 1970 - 31 Mar. 1971
R. Reiter, R. Sladkovic, K. Poetzl, and H. J. Kanter 31 Mar. 1971 193 p
(Contract AT(30-1)-4061)
(NYO-4061-4-Pt-2) Avail: NTIS

The further development and corroboration of a previously described procedure permitting the observation of air mass exchange between the stratosphere and troposphere are presented. A modified procedure of chemical analysis is described, which permits additional separation of S(35) besides the separation of Be(n),P(32), and the heavy metals of the fallout. Counting efficiency and minimum net count rate are precisely determined. Multichannel spectrometry permits identification of the radioisotopes of the fallout. New insights into the mechanism of transport inside the troposphere, between tropopause and recording station, are gained by the computation of several adjacent isentropic trajectories. The techniques employed for sampling and measuring have stood the test of continuous operation, and permit a continuous observation of stratospheric-tropospheric exchange. Author (NSA)

N72-23644# Fraunhofer-Gesellschaft, Garmisch-Partenkirchen (West Germany). Physikalisch-Bioklimatische Forschungsstelle.
[STRATOSPHERIC AIR- PENETRATION INTO TROPOSPHERE] Progress Report, 1 Apr. 1969 - 25 Nov. 1971
Reinhold Reiter 2 Dec. 1971 29 p refs
(Contracts AT(11-1)-3425; AT(30-1)-4061)
(NYO-3425-5) Avail: NTIS

Research on the penetration of stratospheric air into the troposphere continued with daily sampling of the atmosphere at Zugspitze, 2964 m a.s.1. in the Bavarian Alps, and with analysis of samples for fallout heavy metals, ozone, and cosmic-ray generated Be 7, p 32 and S 35 content. The sampling and analysis methods are described in detail. The results are tabulated and plotted for the period from April 1 to Nov. 25, 1971 NSA

N72-23645# Naval Weather Service Command, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS: SOUTHWEST ASIAN COASTAL MARINE AREAS. VOLUME 2: AREA 5, MADRAS; AREA 6, N. E. CEYLON; AREA 7, S. E. CEYLON; AREA 8, W. CEYLON
Dec. 1971 630 p
(AD-736449) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. The area included Southwest Asian coastal areas, Madras and Ceylon.
Author (GRA)

N72-23646# Weather Squadron (17th), Hill AFB, Utah. Detachment 06.
TERMINAL FORECAST REFERENCE FILE, HILL AIR FORCE BASE, UTAH Final Report
Eugene L. Peck 1 Feb. 1972 78 p refs
(AD-737366) Avail: NTIS CSCL 04/2

The reference file discusses factors affecting the weather at Hill AFB, Utah. Included are location and topography, weather controls, climatic aids, and local forecast studies.
Author (GRA)

N72-23647# Air Force Global Weather Central, Offutt AFB, Nebraska.
IMPROVED THREE DIMENSIONAL NEPHANALYSIS MODEL
Allen R. Coburn 1 Jun. 1971 82 p refs
(AD-736798; AFGWC-TM-71-2) Avail: NTIS CSCL 04/2

The AFGWC objective three-dimensional computer program (3DNEPH) produces high resolution, three-dimensional analyses of clouds in the atmosphere. A horizontal grid spacing of approximately 25 nautical miles is used. Analyses are made for 15 layers from the earth's surface to 55,000 feet MSL, with highest vertical resolution near the surface (150 feet depth for layer 1) and lowest vertical resolution at the top of the model (20,000 feet depth for layer 15). The program is a stream of individual processors. The improved program has added a processor to permit forecaster-prepared data to be used, a satellite infrared data processor, a forecast processor and a verification processor. The improved version also includes improvements to the other processors. A description of each major processor is included. Selected samples of displayed data are shown. Author (GRA)

N72-23648# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ABOUT A DISCRIMINANT ANALYSIS AS THE MEANS OF FORECASTING METEOROLOGICAL FIELDS
G. A. Karpeev 30 Nov. 1971 25 p refs Transl. into ENGLISH of Tr. Gidrometeorol. Nauch.-Issled. Tsentr SSSR (USSR), 1969, no. 44 p 53-66
(FTD Proj. 60103)
(AD-736911; FTD-MT-24-1410-71) Avail: NTIS CSCL 04/2

The conditions for applicability of discriminant analysis in prognostic work are determined. It is shown that the usual method for making an optimum forecast using discriminant analysis cannot serve as a basis for determining the comparative success of a combination of prognostic methods. Some possible methods for evaluating the success of forests made using discriminant analysis and a broader class of stochastic forecasts are investigated. The conditions for optimum breakdown of the actual field into some group of nonintersecting classes are formulated. Author (GRA)

N72-23649# Dayton Univ. Research Inst., Ohio.
METEOROLOGICAL AIRBORNE DATA SYSTEM Final Report, Jun. 1968 - Sep. 1971
Donald A. Kahle and Joseph T. Swartzbaugh Nov. 1971 49 p
(Contract F19628-68-C-0201; AF Proj. 8604)
(AD-737349; UDRI-TR-71-54; AFCRL-71-0563) Avail: NTIS CSCL 04/2

The report describes the Meteorological Airborne Data System (MADS) and the associated computer data processing program, explains why the system was developed, and points out the advantages of such a system. The MADS concept was developed to fulfill the need for the collection of a large number of meteorological and related data measurements and to provide a means for the rapid conversion of the raw data into useful information for the scientist. The underlying philosophy for the system design was that it be a very usable system under field data collection conditions and that it provide the scientist with data in the simplest form useful to him and do so within a very short time period. Author (GRA)

N72-23650# Texas A&M Research Foundation, College Station.
RESEARCH ON TROPICAL RAINFALL PATTERNS AND ASSOCIATED MESOSCALE SYSTEMS Semiannual Report, Jun. - Dec. 1971
Walter K. Henry Fort Monmouth, N. J. ECOM Jan. 1972 162 p refs
(Contract DAAB07-71-C-0123; A/M Proj. 778)
(AD-737342; A/M-Ref-72-1T; ECOM-0123-1; SAR-1) Avail: NTIS CSCL 04/2

The study deals with some of the problems generated due to the inherent persistence existing in daily rainfall patterns. The Markov Chain approach is discussed and examples, taken from many tropical areas, show that a one-day persistence chain is sufficiently accurate. However, due to the large standard error of

estimate associated with probabilities calculated from only 20 to 40 years of data, it is shown that seasonal patterns can be obtained with very good accuracy using monthly data; the smoothing introduced thereby is apparently acceptable for practical applications. This is a study of the temporal and areal variation of the precipitation which occurs within a few kilometers of Caracas, Venezuela. The location is adjacent to the Caribbean Sea, but most of this area is separated from the sea by a range of mountains. Caracas is located on the floor of an interior valley. Within this small area the variation of rainfall during the year is large with dry periods in which rain occurs and rainy periods which have extended dry spells. These variations were studied by several means. Author (GRA)

N72-23651# Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Meteorological Physics.
SOME METEOROLOGICAL ASPECTS OF THREE INTENSE FOREST FIRES
R. J. Taylor, D. G. Corke, N. K. King, D. A. MacArthur, and D. R. Packham 1971 20 p refs
(PB-205659; Tech-Paper-21) Avail: NTIS CSCL 04B

A study of three intense forest fires, all of area about 30 sq-km, in which convection extended to heights ranging from 1750 m to 4300 m reported. The observations taken comprise surface-level wind, temperature, and humidity; mean temperature, temperature fluctuations, and vertical acceleration as measured from an aircraft; the rate of change of height of the aircraft while it was held at constant attitude; and wind profiles from double-theodolite pilot-balloon flights. Author (GRA)

N72-23652# Air Force Global Weather Central, Offutt AFB, Nebraska.
AFGWC FORWARD TRAJECTORY MODEL
Donald S. Thomas, Jr. 1 Dec. 1971 17 p refs
(AD-736823; AFGWC-TM-71-4) Avail: NTIS CSCL 04/2

The paper describes the AFGWC Forward Trajectory Model, a customer-oriented global parcel trajectory model. The global capability of this model is a result of the input global wind fields available in the AFGWC data base. The model computes forecast positions out to 72 hours of a parcel of air starting at any pre-determined point, follows the parcel for up to ten days and each cycle provides the current position and forecast positions at each interval during the ten day period. The customer has various options available concerning the construction and use of the trajectories. Author (GRA)

N72-23653# National Oceanic and Atmospheric Administration, Boulder, Colo.
REMOTE SENSING OF POLLUTANTS Annual Report
30 Jun. 1971 52 p
(PB-206734; APTD-0891) Avail: NTIS HC $3.00 CSCL 07D

Research results obtained during FY 71 are summarized: on quantitative infrared spectra of pollutant gases such as CO, O3, HC1, SO2, NH3, and HNO3; on analyzing long path infrared spectra by digital means for atmospheric gas concentrations; on scattering cross section measurements for SO2 and NO; and on literature search and consultative services in atmospheric spectroscopy. Explanations and reviews of the particular results are illustrated by samples of the voluminous transmission tables and graphs supplied separately. The developed information is crucial for proper interpretation of remote sensing field measurements of pollutant concentrations in both source and ambient situations. Author (GRA)

N72-23654# Naval Postgraduate School, Monterey, Calif.
STATISTICAL RESULTS CONCERNING THE RADIOMETRIC TEMPERATURE CHANGES SENSED BY NIMBUS 2 MRIR IN THE VICINITY OF THE SUBTROPICAL JET M.S. Thesis
Paul Brayton Knostman Sep. 1971 46 p refs
(AD-736538) Avail: NTIS CSCL 04/2

Radiances obtained from the 11-micrometer window channel by MRIR scanning radiometer of Nimbus II were investigated in order to determine areas of time change of T(2), which may be related to effective cloud top level of the five-day mean cloud state. A statistical model was developed that is useful in obtaining a valid specification for effective cloud top change, using a stepwise regression program. Author (GRA)

N72-23655# Department of Transportation, Washington, D.C. Library Services Div.
AIRCRAFT AND AIR POLLUTION, SELECTED READINGS Report for 1960 - 1971
Dorothy J. Poehlman Dec. 1971 68 p
(AD-735943; Biblographic-List-7) Avail: NTIS CSCL 13/2

Presented is a selected, partially annotated listing of papers, reports, and periodical articles, on the subject of environmental pollution caused by aircraft emissions. Noise pollution is not included. The period covered is from approximately 1960 - Spring 1971. The arrangement is by subject categories with author, corporate source and geographic indexes. Author (GRA)

N72-23656# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 108, NO. 4: DAILY AND MONTHLY NORTHERN HEMISPHERE 10-MILLIBAR-SYNOPTIC WEATHER MAPS OF THE YEAR 1969. PART 4, OCTOBER - DECEMBER Final Quarterly Technical Status Report, Oct. - Dec. 1969
Dietrich Just, Barbara Kriester, Karin Labitzke, Renate Lenschow, Karin Petzoldt, Wolfgang Roeder, Richard Scherhag, and Karl Sieland 1971 117 p
(Contract DAJA37-70-C-2330)
(AD-737085; OR-4-Pt-4) Avail: NTIS; HC Freie Univ., Berlin CSCL 04/2

The present volume continues the series of stratospheric weather maps published since 1957 in the Meteorologische Abhandlungen of the Meteorological Institute of the Free University. It contains daily height and temperature analysis of constant pressure levels for three months for the whole of the northern hemisphere, based on rawinsonde and in the upper stratosphere also on rocketsonde data and performed with the aid of a hydrostatic build-up method. The corresponding monthly mean maps, their variations and deviations are included as well as the mean gridpoint data, calculated from daily values. Author (GRA)

N72-23657# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
THE LIGHT SCATTERING PROPERTIES OF CLOUDS. VOLUME 1: ANALYSIS OF EXPERIMENTAL RESULTS Research Report, Jan. 1967 - Jul. 1971
Richard T. Hall and R. Douglas Rawcliffe 30 Nov. 1971 74 p refs
(Contract F04701-71-C-0172)
(AD-736815; TR-0172(2129-01)-2-Vol-1; SAMSO-tr-71-337) Avail: NTIS CSCL 04/2

The results for single layer overcast clouds were found to correlate well with standard hemispheric and narrow angle pyreheliometric transmittances. The resulting expression for the angular scattering profile of an overcast cloud layer is given. Author

N72-23658# Stanford Univ., Calif. Dept. of Geophysics.
MICROBAROGRAPH STUDIES 3: TELEBAROMS AT LASA Final Report, Mar. - Sep. 1971
Jon F. Claerbout and Lee Lu 30 Dec. 1971 40 p refs
(Contract F44620-69-C-0073; ARPA Order 1362; ARPA Proj. 9F20)
(AD-736539; AFOSR-72-0269TR) Avail: NTIS CSCL 04/2

The document is the final report of atmospheric wave studies project at the Stanford Geophysics Department. Work consists of computer modeling of global infrasonic waves and

atmospheric turbulence, particularly the kind that interferes with the reception of infrasonic waves. Correlation is made between microbarometric waves and the weather and jet stream situation. GRA

N72-23659# RAND Corp., Santa Monica, Calif.
GLOBAL TURBIDITY STUDIES. 1: VOLCANIC DUST EFFECTS; A CRITICAL SURVEY
D. Deirmendjian Oct. 1971 75 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-736686; R-886-ARPA) Avail: NTIS CSCL 04/2

Critical evaluation is given of the role of the volcanic dust introduced by three major eruptions (Krakatoa (1883), Katmai (1912), and Agung (1963)) in increasing atmospheric particulate turbidity. Typical turbidity anomalies, expressed as absolute increments in optical thickness in the middle of the visual spectrum, are found to be 0.55 for Krakatoa, 0.35 for Katmai, and 0.25 for Agung. The last represents a five-fold increase of normal turbidity away from cities over a period of 2 to 3 years. No evidence of climatic effects directly related to the volcanic dust incursions is found. The possible contribution by the operation of 500 commercial supersonic transport vehicles to particulate turbidity is estimated to be small and climatologically not significant. An initial black cloud experiment, consisting of a simple reduction by 10 to 20 percent of the incoming short-wave radiation, is suggested for use with numerical models of atmospheric circulation to simulate volcanic dust effects. Author (GRA)

N72-23331*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLOBAL WINDS FROM NIMBUS TEMPERATURE DATA FOR JULY 1970
Joseph S. Hogan *In its* Significant Accomplishments in Sci., 1970 1972 p 32-36 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 04B

N72-23332*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CLIMATIC MODIFICATION BY CO2, H2O, AND AEROSOL
Ichtiaque Rasool *In its* Significant Accomplishments in Sci., 1970 1972 p 37-42 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 04B

N72-23335*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVIDENCE FOR THE TROUGH WIND
Henry Brinton *In its* Significant Accomplishments in Sci., 1970 1972 p 52-57 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 04B

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N72-23660 Ohio Univ., Athens.
OPTIMUM ADAPTIVE PHASE ESTIMATION RECEIVER FOR ONE-WAY RANGING AIRCRAFT NAVIGATION Ph.D. Thesis
Patrick Henry Garrett, II 1970 176 p
Avail: Univ. Microfilms Order No. 71-16486

One-way ranging was used to measure the phase delay of a transmitted electromagnetic wave measured at an aircraft as a function of the intervening station-to-aircraft distance. Two or more stations are required to obtain position fixes. Principles of statistical communication theory were used to provide the basis for an adaptive maximum likelihood phase estimation receiver, formulated in terms of Bayes' rule to permit the inclusion of a priori information about the phase efficiently in the receiver structure. A Marko process aircraft position prediction model was derived and mechanized to provide information based on prior signal measurements. Theoretical studies and comparisons with other receiver structures, such as conventional phase-locked loops, independent verification by digital and hybrid computer simulation methods, and flight experiments with actual hardware prototype receivers provided conclusive results. Dissert. Abstr.

N72-23661 George Washington Univ., Washington, D.C.
APPLICATION OF OPTIMAL CONTROL THEORY TO ATTITUDE CONTROL WITH CONTROL MOMENT GYROSCOPES (CMGs) Ph.D. Thesis
Jack Kranton 1970 239 p
Avail: Univ. Microfilms Order No. 71-19638

Practical applications of optimal control theory are developed for the design of CMG control laws which govern the attitude hold and maneuvering functions or large, earth-orbiting, manned spacecraft. The design of a CMG control law for each function is shown to be a two-part problem: first, to optimally select the desired control torque, and second, to optimally determine the CMG gimbal angle rates so as to produce the desired control torque. For attitude hold, the desired control torque has two components: first, the nominal external torque, calculated from analytical models of the gravity-gradient and aerodynamic torques, and second, a supplementary torque, calculated from the linearized equations of motion, to counteract the effects of crew motion disturbances. Dissert. Abstr.

N72-23662 Minnesota Univ., Minneapolis.
ON THE OPTIMUM STABILIZATION OF A SPINNING SPACE STATION Ph.D. Thesis
Ching Li Yi 1971 83 p
Avail: Univ. Microfilms Order No. 71-22266

The problem of stabilizing a spinning space station with a single axis of symmetry when crew and equipment move within the station, is studied. The station is composed of two rigid bodies in the form of a wheel, with an outer rim which rotates at constant angular velocity and a center hub. Crew members and equipment move in two prescribed paths, along the rim (circular motion) and through the shaft (radial motion) in the station. Motion of crew and equipment is predetermined; also, sensors for measuring the angular velocities of the station and a computer are available such that a feedback controller can be synthesized to stabilize the system. The ideal stabilization system would maintain a constant angular velocity about the axis of symmetry and reduce the angular velocities about the other two axes to zero. This process occurred in an optimal sense corresponding to a quadratic cost functional. Dissert. Abstr.

N72-23663 Compagnie Francaise Thomson Houston-Hotchkiss Brandt, Paris.
DOPPLER SYSTEM GRANULARITY
P. Fombonne Jul. 1970 17 p
(AT/DTRN/2174) Avail: Issuing Activity

Theoretical analysis of a proposed method to reduce the granularity in a Doppler system signal spectrum using direct frequency counting is reported. The method involves phase shifts from one scan to the next in order to reduce the granularity of the angular information transmitted by a network of switched sources. It is concluded that the signal must be filtered through a 2/T bandwidth in order to preserve its main features, T being the scan duration. It is shown that the proposed phase shifting technique lowers the granularity inherent in direct frequency counting. Author (ESRO)

N72-23664*# Drexel Univ., Philadelphia, Pa.
DEVELOPMENT OF VISUAL-DISPLAY AID TO AIR NAVIGATION Annual Report, 1 Jan. - 31 Dec. 1971
T. J. Matcovich Feb. 1972 101 p refs

(Grants NGR-39-004-038; NSF GK-17861)
(NASA-CR-112062) Avail: NTIS HC $7.25 CSCL 17G

The design, development, and fabrication of a visual display aid to air navigation are discussed. The display will locate an aircraft on a standard navigational chart when activated by two independent directional signals. The display consists of a radial pattern of electrically conductive line pairs, liquid crystal material contained between the line pairs, and addressing and activating electronics. The application of a voltage to the addressed line pair will cause the liquid crystal to become white in color, thus indicating the direction to the selected VOR station. Author

N72-23665*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SIMPLIFIED INTERPLANETARY GUIDANCE PROCEDURES USING ONBOARD OPTICAL MEASUREMENTS
Harold A. Hamer and Katherine G. Johnson Washington May 1972 29 p refs
(NASA-TN-D-6752; L-7630) Avail: NTIS HC $3.00 CSCL 17G

Simplified guidance procedures have been developed which are based on preflight determination of the characteristics of perturbed trajectories. The results are devoted primarily to planetary approach guidance; however, some considerations for midcourse guidance are included. The methods are studied for an Earth-to-Mars trajectory but would be applicable to Grand Tour and other types of missions. Generally requiring only a single onboard optical angular measurement, the approach procedure predicts guidance corrections for the control of periapsis radius as well as orbital plane orientation. An error analysis has shown that the periapsis radius at Mars can be controlled to a 1 sigma accuracy of about 20 km if the guidance is performed 1/2 day before periapsis passage. If the guidance is performed at the Martian sphere of influence (2.2 days before periapsis), the error doubles because of the increased effect of measurement and maneuvering errors. Author

N72-23666# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
KALMAN FILTER WITH COMPLEMENTARY CONSTRAINT AND INTEGRATED NAVIGATION SYSTEMS APPLICATIONS
L. E. Ott and R. G. Brown Feb. 1972 154 p refs
(Contract N00014-68-A-0162; Proj. Themis)
(AD-737336; ERI-72022) Avail: NTIS CSCL 17/7

The report presents a method of navigation system integration that yields an optimal system regardless of the particular redundancy in available sensor data. The proposed mechanization is based on the criterion that the statistics of the signal are unknown. This results in the concept of distortionless or complementary filtering; an extensive review of this concept is presented. When the measurement errors for the Kalman filter are independent, it is shown that the inputs can be processed sequentially, even with the complementary constraint imposed. Thus, if there is an input that is not available, it is simply passed over, and an optimal estimate is still obtained from the remaining inputs. This even allows for a failure in the inertial navigation unit itself, whereas in most hybrid inertial systems to date this would be impossible. Author (GRA)

N72-23667# Federal Aviation Administration, Oklahoma City, Okla. National Flight Inspection Div.
EVALUATION OF VOR FIX LIMITATIONS Final Report
D. D. Murphy, Allan W. Hunting, and Frank Parr Jan. 1972 63 p
(FAA Proj. FS-460-8)
(AD-736867; FAA-FS-600-4) Avail: NTIS CSCL 17/7

A Flight Standards evaluation of non-precision (VOR) approach was made to determine whether the final approach fix distance specified in TERPs can be increased without derogation of procedure flyability. Two published VOR procedures and two additional VOR procedures designed for evaluation purposes were flown under simulated instrument conditions for comparison of flyability problems on final approach distances of 3.5, 7.0, 10.5, and 18.5 NM. Author (GRA)

N72-23668# Mitre Corp., McLean, Va.
COST ANALYSIS OF THE MICROWAVE LANDING SYSTEM PROGRAM Final Report
Thomas L. Croswell Dec. 1971 110 p refs
(Contract DOT-FA70WA-2448)
(AD-737036; MTR-6068; FAA-EM-71-1) Avail: NTIS CSCL 17/7

The report describes a cost study performed for the new replacement all weather instrument landing system. Costs are determined for two Scenarios: (A) following the National Plan for Microwave Landing Systems, and (B) those currently operational systems (GCA - ILS ...) expected to exist in the absence of the national MLS. For civil ground systems, Scenario A (MLS) produces a significant cost saving; resulting principally from the elimination of restrictive site requirements and reduced frequency of flight inspections. Military ground systems also favor MLS due to earlier retirement of GCA systems. Both of these cost savings are offset by the extra cost of airborne MLS, especially to the more than 700,000 general aviation aircraft projected for the year 2000. Over a 30-year period, the total costs to the nation under the MLS plan are not significantly higher than costs of continuing with current systems. The conclusion is that the lack of a cost penalty, combined with the performance, safety, and economic benefits, make a solid case for MLS. Author (GRA)

N72-23669# Transportation Systems Center, Cambridge, Mass.
AN INVESTIGATION OF MICROWAVE LANDING GUIDANCE SYSTEM SIGNAL REQUIREMENTS FOR CONVENTIONALLY EQUIPPED CIVILIAN AIRCRAFT
Maurice H. Lanman, III Jun. 1971 186 p refs
(AD-737339; DOT-TSC-FAA-71-24; FAA-RD-71-86) Avail: NTIS CSCL 17/7

The report describes efforts leading to the determination of minimum suitable scan rates for the azimuth and elevation functions of the microwave Landing Guidance System (LGS) proposed by RTCA SC-117, based on performance requirements of two conventionally equipped civilian aircraft. Two complementary methods are used; one involving a full nonlinear digital simulation, the other involving direct covariance matrix propagation. Wind and turbulence models, aircraft models and LGS models are described in detail. Author (GRA)

N72-23670# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TEST AND EVALUATION OF ENGINEERING MODELS OF TERMINAL AREA DME Final Report, Feb. 1970 - Jul. 1971
George J. Hartranft Mar. 1972 83 p
(AD-737341; FAA-NA-72-25; FAA-RD-71-108) Avail: NTIS CSCL 17/7

The report covers the testing of testing of two-powered distance measuring equipment (DME). The laboratory tests dealt with the effects of continuous wave CW interference on reply delay, receiver sensitivity, and squitter rate; the effect of various squitter rates on airborne interrogators, the effect of various interrogation levels on receiver delay, and the effects of various transmitted pulse parameters on the pulse pair spectrum. The flight tests identified the coverage area provided by a 90-watt DME ground station to various commercial and general aviation type DME interrogators. Author (GRA)

N72-23671# Lincoln Lab., Mass. Inst. of Tech., Lexington.
INTERROGATION SCHEDULING FOR THE DISCRETE ADDRESS BEACON SYSTEM
E. J. Kelly 24 Jan. 1972 59 p refs
(Contracts F19628-70-C-0230; DOT-FA72WAI-242; FAA Proj. 034-241-021)
(AD-737294; ATC-8; FAA-RD-72-7) Avail: NTIS CSCL 17/7

The report is an attempt to define the interrogation scheduling problem which arises in the implementation of the discrete address beacon idea. The interfaces of this problem with other parts of the beacon system design are discussed, and

several specific algorithms for scheduling are analyzed for both arrays and rotating antennas. GRA

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N72-23672# Joint Publications Research Service, Arlington, Va.
THEORY OF CAVITY REACTORS WITH COMPRESSIBLE FUEL
V. L. Blinkin and V. M. Novikov 30 Mar. 1972 51 p refs Transl. into ENGLISH of "K Teorii Polostnykh Reaktorov so Szhimayemym Goryuchim", Rept. IAE-2139 and IAE-2140 Moscow, 1971 p 1-17 and 1-20
(JPRS-55582) Avail: NTIS HC $4.75

A theory to explain the characteristics of cavity reactors with compressible fuel was developed. Subjects which are presented to support the theory are: (1) dynamic characteristics with oscillations in fuel density and (2) dynamic reactivity as a function of system parameters. Mathematical models are included to support the theoretical concepts. For individual titles, see N72-23673 through N72-23674.

N72-23673# Joint Publications Research Service, Arlington, Va.
DYNAMIC CHARACTERISTICS WITH OSCILLATIONS IN FUEL DENSITY
In its Theory of Cavity Reactors with Compressible Fuel 30 Mar. 1972 p 1-22 (See N72-23672 14-22)
(IAE-2139) Avail: NTIS HC $4.75

The dynamic characteristics of cavity reactors with oscillations in fuel density are discussed. Their application for MHD generators and power installations are considered. The static properties of the reactors have been studied and the influence of fuel compressibility has been investigated. The study of the relationship of the breeding factor to the time-dependent effective boundary conditions at the surface of the core of a cavity reactor was conducted. Mathematical models of the relationships are included. Author

N72-23674# Joint Publications Research Service, Arlington, Va.
DYNAMIC REACTIVITY AS A FUNCTION OF SYSTEM PARAMETERS
In its Theory of Cavity Reactors with Compressible fuel 30 Mar. 1972 p 23-50 refs (See N72-23672 14-22)
(IAE-2140) Avail: NTIS HC $4.50

The dynamic reactivity of cavity reactors as a function of system parameters is discussed. The effects of fluctuations on the fuel density, moderator parameters and system geometry are analyzed. Centrally symmetrical and axisymmetrical acoustic oscillations as well as oscillations of the total fuel mass, are described. Numerical analyses and mathematical models are included to support the theoretical aspects. Author

N72-23675*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN OUT-OF-CORE THERMIONIC-CONVERTER SYSTEM FOR NUCLEAR SPACE POWER
Roland Breitwieser 1972 26 p refs Presented at 3d Intern. Conf. on Thermionic Elec. Power Generation, Juelich, West Germany, 5-9 Jun. 1972
(NASA-TM-X-68049; E-6890) Avail: NTIS HC $3.50 CSCL 18I

Design of the nuclear thermionic space power system, 40 50 70 Kw(e) power range, are given. The design configuration (1) meets the constraints of readily available launch vehicles; (2) allows for off-design operation including startup, shutdown, and possible emergency conditions; (3) provides tolerance of failure by extensive use of modular, redundant elements; (4) incorporates and uses heat pipes in a fashion that reduces the need for extensive in-pile testing of system components; and (5) uses thermionic converters, nuclear fuel elements, and heat transfer devices in a geometrical form adapted from existing incore thermionic system designs. Designs and in some cases performance data for elements and groups of the elements of the system are included. Benefits of the highly modular system approach to reliability, safety, economy of development, and flexibility are discussed. Author

N72-23676# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
NONDESTRUCTIVE TESTING OF IRRADIATED FUEL ELEMENTS IN THE UNITED STATES OF AMERICA
R. W. McClung 1971 13 p refs Presented at Meeting on NDT for Reactor Core Components and Pressure Vessels, Vienna, 29 Nov. 1971 Sponsored by AEC
(Conf-711114-1) Avail: NTIS HC $3.00

Many nondestructive testing techniques are being used to examine fuel elements after irradiation. Penetrating radiation techniques include both neutron and X-radiography. Ultrasonic techniques are used to inspect bonding and to detect flaws in cladding; eddy-current techniques are used to measure spacing between components, measure thickness, and detect flaws. A variety of mechanical devices are used to measure physical dimensions. Author (NSA)

N72-23677# Battelle-Northwest, Richland, Wash.
ACOUSTIC EMISSION MONITORING FOR CONTINUOUS CRACK DETECTION IN NUCLEAR REACTOR PRESSURE BOUNDARIES
P. H. Hutton Nov. 1971 40 p refs
(Contract AT(45-1)-1830)
(BNWL-1597) Avail: NTIS HC $4.00

A program to develop application of acoustic emission techniques to reactor system integrity surveillance is reviewed. Capabilities resulting from this program include use of acoustic emission monitoring to detect and locate flaws in pressure vessels and piping during hydrostatic testing, flaw formation during welding, incipient fatigue failure points in metal structures and stress corrosion cracking in metals. Better definition of the acoustic emission signal and propagation was achieved, as well as development of specialized detection instrumentation and suitable techniques for data analysis (including real-time source location techniques). Author (NSA)

N72-23678# Idaho Nuclear Corp., Idaho Falls.
ULTIMATE STORAGE OF RADIOACTIVE WASTE
Cyril M. Slansky 14 Sep. 1971 12 p refs Presented at the Regional Training Course in Radioactive Waste Management Conf., Tokyo, 4-24 Nov. 1971 Sponsored by AEC
(Conf-711113-5) Avail: NTIS

The ultimate storage of high level radioactive wastes is defined as storage on earth with the following conditions: storage periods of the order of a million years, inaccessibility of the waste to man or his food chain, no surveillance or maintenance, and costs that would be commensurate with the benefits. Availability of the method to all nuclear nations would be a desirable characteristic. Methods for ultimate storage in ocean trenches and depths and for underground storage in salt deposits, crystalline bedrock cavities, and hydrofractured shale formations are discussed. Finally, methods for ultimate disposal, i.e., eliminating the waste from the earth environment by transmutation of the radioisotopes to stable isotopes or by waste shipment to other planets or the sun, are described. It is concluded that, at present, the most favorable ultimate storage conditions are in deep underground cavities in geologic formations and that further experimental research must be done to evaluate deep ocean regions and nuclear cavities as ultimate storage sites. NSA

N72-23679# Argonne National Lab., Ill.
REACTOR DEVELOPMENT PROGRAM Progress Report
29 Dec. 1971 180 p refs
(Contract W-31-109-eng-38)
(ANL-7887) Avail: NTIS

The EBR-2 operations, fuels and materials studies, and engineering development activities are reported. LMFBR design support programs are reviewed. Instrumentation development for LMFBR and FFTF is described. Sodium monitoring and sampling systems for the LMFBR and FFTF are reviewed. Performance characteristics of LMFBR fuel elements are described. Fuel processing methods are discussed. Physics measurements are presented for ZPR-3 Assembly 53, ZPR-6 Assembly 7, and ZPPR Assembly 2. LMFBR fuel element failure characteristics are analyzed. Thermal effluent studies in Lake Michigan are reviewed. NSA

N72-23680# Oak Ridge National Lab., Tenn.
FAST REACTOR SHIELDING, ACTIVITY NO. 40 01 61, 189A NO. 10028 Monthly Progress Report, Nov. 1971
F. R. Mynatt, C. E. Clifford, M. L. Gritzner, and R. E. Maerker
31 Dec. 1971 36 p Sponsored by NASA
(ORNL-TM-3666) Avail: NTIS HC $4.00

Progress is reported for research on fast test and liquid metal fast breeder reactor shielding. E.H.W.

N72-23681# Japan Atomic Energy Research Inst., Tokyo.
INVESTIGATION OF THERMAL NEUTRON FLUX ON JPR-4 FLUX-TRAP CORE
Nobuaki Ohnishi and Chuzo Kutsukake Jun. 1971 16 p refs In JAPANESE; ENGLISH summary
(JAERI-M-4471) Avail: NTIS HC $3.00

JPR-4 is being widely used for nuclear physics, reactor engineering, radioisotope production, reactor training, and shielding experiments. Investigation of power-up and flux-trap core was carried out in the technical aspects. The results of experiments and calculation are presented on the JPR-4 flux-trap core. The flux-trap was obtained in the center of reactor core by substituting light moderator for a fuel element; and the thermal neutron flux distribution was measured by Cu tape irradiation in the flux-trap and a fuel element placed nearest to the flux-trap. From the experiments, the maximum thermal neutron flux was estimated, and it was also found that the thermal neutron flux distribution had a steep gradient in the nearby fuel elements. Author (NSA)

N72-23682# Atomic Weapons Research Establishment, Aldermaston (England).
DESCRIPTION OF THE RESEARCH REACTOR HERALD
D. Hindley Dec. 1971 46 p
(AWRE-O-72/71) Avail: AEC Depository Libraries; HMSO 60p; PHI $2.55

HERALD is a light water moderated and cooled reactor operated at power levels up to 5 MW and used for neutron beam research, materials testing, and small scale radioisotope production. The reactor is described in sections: location of the reactor, general description, reactor core, fuel elements, reflector elements, lead elements, lattice plate, locking grids, control absorbers, control rods, core box and support, reactor tank, cooling water outlet pipe, thermal shield and biological shield, beam tubes and thermal column, reactor top gantry, cooling water system, core emergency spray, ventilating system, reactor hall crane, instrumentation, cooling water inlet temperature, nitrogen-16 monitors, cooling water flow meters, neutron doubling-time amplifiers, neutron linear amplifier and automatic control, safety, interlock and control circuits, depth of water in reactor tank, fission product detection, emergency evacuation alarms, control rod clutch release and rod drop timers and ancillary instrumentation. NSA

N72-23683# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
INTERNAL SOURCES OF HYDROGEN IN UNIRRADIATED UO2 FUEL ELEMENTS
A. S. Denovan, R. W. Ashley, and T. H. Longhurst Oct. 1971 23 p refs
(AECL-4063) Avail: AEC Depository Libraries; Atomic Energy of Can., Chalk River: $1.00

An investigation was carried out to determine the source of hydrogen causing localized hydriding in the zirconium alloy sheathing of fuel elements. The sources examined were hydrocarbons, molecular hydrogen, water in fuel elements, and internal contamination of sheathing. Both the fuel element filling gas and gases absorbed by the UO2 fuel pellets were analyzed. Studies were also carried out to determine the extent of pickup of hydrogen during the sintering process and of water from the atmosphere by fuel pellets. The conclusions reached were that the major contributor to hydrogen in fuel elements was water adsorbed on the surface of fuel pellets. Author (NSA)

N72-23684# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
IRRADIATION OF AN EMITTER ELEMENT FOR A THERMIONIC CONVERTER EXPERIMENT DICOM-01
H. Hausner, R. Klersy, A. Schuerenkaemper, and O. Simoni
12 Jul. 1971 26 p
(EUR-4711) Avail: AEC Depository Libraries; EUR F. Fr. 4.45

The irradiation of a vented emitter element for a thermionic converter is described. This emitter type could be used in a thermionic fuel element, in which the converters are connected in parallel. The irradiation device is discussed, and the irradiation conditions together with the results of the post-irradiation examination are presented. Author (NSA)

N72-23685# Internationale Atomreaktorbau Gesellschaft, Bensberg (West Germany).
INCORE THERMIONIC REACTOR (ITR)
R. Pruschek, F. Gross, H. Stehle, J. Fassbender, K. H. Hoecker, and W. Oldekop May 1971 23 p refs Presented at 4th Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971
(AED-Conf-71-100-17; Conf-710901-521) Avail: AEC Depository Libraries

The goals of the incore thermionic reactor (ITR) program are to develop, construct, and test a power source which utilizes incore thermionic diodes for direct conversion of heat to electricity. The initial phase of the program is to build and test a 20 kW(e) reactor. The reactor and test facility are described, and some potential space power applications for an ITR are discussed. NSA

N72-23686# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
THE OTHELLO LOOP
G. Colomez May 1971 12 p ref In FRENCH Presented at EURATOM Conf. on Radiation Devices, Cadarache, France, 10-11 Jun. 1971
(CEA-CONF-1881; Conf-710628-3) Avail: AEC Depository Libraries

The Othello loop, which was designed to irradiate structural elements in a CO2 environment, has been modified to test fuel elements under their nominal operating conditions in high temperature reactors. During the power cycling, the loop may be placed outside the reactor vessels, the removal from the core being effected only when the reactor is shut down. The immersed part is connected to an out-of-pile circuit by electrical connections and gas piping contained in pressurized metallic tubing. The current version has the following characteristics: channel diameter = 41 millimeters, maximum sample length = 400 millimeters; coolant gas: He at 60 bars with a mass flow rate of 33 g/sec; cooling power of 25 kW (maximum linear power of flux = 700 W/cm); in-pile and out-of-pile He volumes 1 cu m and 8 cu m at STP respectively. NSA

N72-23687# Aerojet Nuclear Co., Idaho Falls, Idaho. Nuclear Technology Div.
NUCLEAR RESEARCH AND TECHNOLOGY Annual Progress Report, period ending 30 Jun. 1971
Oct. 1971 556 p refs
(Contract AT(10-1)-1375)
(ANCR-1016) Avail: NTIS

Research and development progress is reported on neutron interactions, nuclear properties, materials, test reactors, experimental facilities, radiometric methods, and applied mathematics. NSA

N72-23688# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
QUANTITATIVE DETERMINATION OF THE STRUCTURE-PROPERTY RELATIONSHIPS IN NUCLEAR FUEL ELEMENT MATERIALS Quarterly Progress Report, 16 Jun. - 15 Sep. 1971
F. N. Rhines, R. T. DeHoff, and E. D. Whitney Oct. 1971 31 p ref
(Contract AT(38-1)-552)
(SRO-552-9; ORO-4212-9) Avail: NTIS

Continued experimental progress was achieved in the areas of quantitative microstructural analysis, gas permeability studies, short time mechanical properties, high temperature creep, and thermal conductivity measurements. In addition, improvements were realized in uranium dioxide specimen fabrication techniques through the completion and successful operation of a hot pressing apparatus. Knowledge of the general dependence of mechanical properties upon a geometric state was extended and strengthened as a result of studies of the relationship between interparticle fracture areas and extent of creep in nickel sinterings, and through analysis of fracture type as related to density in sintered uranium dioxide bodies. Author (NSA)

N72-23689# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
TRANSFORMATION KINETICS AND MECHANICAL PROPERTIES OF THE URANIUM-7.5 NIOBIUM-2.5 ZIRCONIUM TERNARY ALLOY
Ross J. Jackson and Joseph F. Boland 21 Dec. 1971 13 p refs
(Contract AT(29-1)-1106)
(RFP-1652) Avail: NTIS

The mechanical test data are correlated with metallographic and X-ray studies. These alloys, although transition-phase, supersaturated solid solutions, are weakest in the asquenched condition. Aging the alloys for up to 80-hour periods at temperatures below 400 deg C results in a noticeable increase in strength with no loss in supersaturation. The data are interpreted in terms of plastic deformation occurring by the motion of twin interfaces and in the pinning of twin interfaces by ordering on aging. A wide variety of mechanical properties are available from this heat treatable and corrosion-resistant alloy, and it shows promise as an economic, high density, engineering material in both nuclear and non-nuclear applications.
Author (NSA)

N72-23690# European-American Nuclear Data Committee, Paris (France).
NUCLEAR DATA RESEARCH IN THE EURATOM COMMUNITY Progress Report, 1 Jan. - 31 Dec. 1970
Aug. 1971 210 p refs Partly in ENGLISH; partly in GERMAN; partly in FRENCH
(EANDC(E)-140-U) Avail: AEC Depository Libraries

Research in many different areas of nuclear physics is sketched. Most of the work is basic research of an experimental nature; however, there are also reports on reactor physics, chemistry, accelerators, and instrumentation. NSA

N72-23691# California Univ., Berkeley.
PULSED HEAVY ION SOURCE FOR THE BEVATRON
H. A. Grunder, R. M. Richter, M. M. Tekawa, and E. Zajec Oct. 1971 5 p refs Presented at Intern. Conf. on Multiply-Charged Ion Sources and Accelerating systems, Gatlinberg, Tenn., 25 Oct. 1971
(Contract W-7405-eng-48)
(LBL-304; Conf-711021-8) Avail: NTIS

A philips' ion gauge source of the type by the heavy ion accelerator in Berkeley was adapted for use at the Bevatron. The objectives was to achieve high charge state ions (4+,5+) of carbon and nitrogen. All source parameters are pulsed. The ion source performance regarding linac acceleration is discussed. The light ion (deuteron, alpha) performance of the PIG source and duoplasmatron is compared. Author (NSA)

N72-23692# Helsinki Univ. (Finland).
CONSTRUCTION AND OPERATION OF A NUCLEAR REFRIGERATION CRYOSTAT Ph.D. Thesis
R. G. Gylling Finnish Acad. of Tech. Sci. 1971 69 p refs
(PB-205950; APS-CH-81) Avail: NTIS HC $3.00; Acta Polytech. Scandinavica Publishing Office, Box 5073, Stockolm 5 (Sweden) Sw. Kr. 10.00 CSCL 14B

An effort was made to combine the dilution method with the new types of superconducting magnets and thus develop nuclear refrigeration from an exotic laboratory curiosity to a useful tool for ultralow temperature research. Much of the effort was put into designing and building a very effective dilution refrigerator that would continuously provide the high cooling power and low limiting temperature needed. In order to make use of this, efficient methods had to be developed for making thermal contact between the nuclear stage and the liquid in the mixing chamber of the dilution refrigerator. GRA

N72-23693# Mount Aubum Research Associates, Inc., Newton Upper Falls, Mass.
STUDY OF ACOUSTIC GRAVITY WAVE GENERATION BY NUCLEAR DETONATIONS Semiannual Technical Report, 16 Feb. - 31 Aug. 1971
Brian L. Murphy and Andrew D. Zalay 30 Sep. 1971 141 p refs
(Contract F44620-71-C-0086; ARPA Order 1502)
(AD-737127; AFOSR-72-0378-TR) Avail: NTIS CSCL 18/3

Three different acoustic phenomena relevant to nuclear test detection and diagnostics are discussed in this report: (1) The generation of long period (3-10 minute) acoustic-gravity waves is analyzed in terms of a Lamb mode propagation theory. One result of the analysis is that yield-amplitude proportionality is predicted to break down for very large yield detonations. (2) The generation and propagation of short period (1-60 seconds) acoustic pulses is treated by means of weak shock theory. Yield and height of burst scaling laws are derived for the far-field period. The dependence of period on atmospheric conditions and propagation path is also discussed. (3) The variation of long range Rayleigh wave amplitude with yield and height of burst is discussed for detonations at lower altitudes than previously treated. Author (GRA)

N72-23694# Naval Ordnance Lab., White Oak, Md.
RADIOACTIVITY RELEASE FROM RADIONUCLIDE POWER SOURCES. 9: RELEASE FROM THULIUM-170/171 OXIDE AND PROMETHIUM-147 OXIDE TO SEAWATER Final Report
Donald Kubose, Ming Lai, and Harry Goya 8 Dec. 1971 19 p refs
(AD-736603; NOLTR-71-206) Avail: NTIS CSCL 18/12

In the event that a radioisotope-fueled SNAP (Systems for Nuclear Auxiliary Power) unit is placed accidentally in an ocean environment the potential release of the radioisotopic fuel material to the ocean environment may generate a radiological hazard. Studies of the nature and extent of such a release are required for assessment of the magnitude of the radiological hazard. The present report describes the dissolution behavior of two other candidate fuels, thulium-170/171 oxide and promethium-147 oxide, in seawater and in seawater-ocean-bottom material mixtures. Plots of the amounts of Pm_2O_3 and Tm_2O_3 released to seawater are presented. Author (GRA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N72-23695* Massachusetts Inst. of Tech., Cambridge.
OPTICAL FREQUENCY WAVEGUIDE AND TRANSMISSION SYSTEM Patent
Charles H. Townes, Raymond Y. Chiao, and Elsa M. Garmire, inventors (to NASA) Issued 24 Jan. 1969 8 p Filed 24 Jan. 1969 Continuation-in-part of US Patent Appl. SN-494739, filed 11 Oct. 1965 Sponsored by NASA Prepared for JPL
(NASA-Case-HQN-10541-3; US-Patent-3,606,522; US-Patent-Appl-SN-822089; US-Patent-Class-350-171) Avail: US Patent Office CSCL 20F

A method and system of transmitting and distributing optical frequency radiation are described. The power level of the radiation beam is maintained at a level which is a function of the pressure and dielectric constant of a gas through which the beam is transmitted. The beam through the gas generates its own waveguide to prevent beam divergence.
Office Gazette of the U.S. Patent Office

N72-23696*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OPTICAL POLARIMETRIC PROPERTIES OF THE ECHO 2 AND PAGEOS 1 ENGINEERING SURFACES M.S. Thesis - Virginia Univ.
Robert Benjamin Lee, III 1972 84 p refs
(NASA-TM-X-67706) Avail: NTIS HC $6.25 CSCL 20F

Experimental investigations of the percent polarization of sunlight reflected from the surfaces of each of the Echo 2 Satellite and PAGEOS (Passive Geodetic Earth Orbiting Satellite) were performed to determine the stability of their surfaces in the space environment. The Echo 2 surface material was amorphous phosphate chemically bonded to a rolled aluminum substrate while the PAGEOS 1 surface material is vapor deposited aluminum on a poly (ethylene terephthalate) film. The stability of the satellites' surfaces was analyzed by comparing the light polarizing properties of the satellites, to those of test surfaces representative of the satellites' surfaces. The properties of flat test surfaces were measured experimentally in the laboratory, and the effects of surface strain, surface geometry, and vacuum upon these properties were examined. The laboratory analyses revealed that the polarization properties of the Echo 2 surface were significantly affected by surface geometry and vacuum, and that the properties of the PAGEOS 1 surface were not significantly altered by any of the above mechanisms. Author

N72-23697# National Bureau of Standards, Washington, D.C. Building Research Div.
TRUCK TIRE NOISE. 1: PEAK A-WEIGHTED SOUND LEVELS DUE TO TRUCK TIRES Final Report
Sep. 1970 249 p refs
(Contract DOT-AS-10004)
(OST-ONA-71-9) Avail: NTIS HC $14.50

An inventory of peak A-weighted sound levels is presented which were measured during parametric study conducted to characterize the noise generated by typical rib, cross bar and retread-type truck tires. A test sample of nine tread designs, estimated to represent 70 to 80% of the truck tire population on the road today, was investigated, considering the following variables: wear, loading, speed, pavement surface, and tire location. Test vehicles included both single-chassis vehicles and a tractor-trailer. The results show that the A-weighted sound level increased with either an increase in load or speed. A discussion is included for the measurement and analysis techniques utilized for the establishment of this data base. Author

N72-23698# Joint Publications Research Service, Arlington, Va.
A NEW SCIENCE: OPTRONICS
E. Adirovich 24 Apr. 1972 6 p Transl. into ENGLISH from Izv. (Moscow), 6 Apr. 1972 p 5
(JPRS-55785) Avail: NTIS HC $3.00

Problems and processes in the field of electro-optics are discussed. Fiber optics and applications for data processing and information handling of cybernetic systems are considered.
K.P.D.

N72-23699# Lyon Univ. (France). Inst. de Physique Nucleaire.
MEASUREMENT OF THE ELECTROMAGNETIC FIELD IN AN INTERDIGITAL STRUCTURE. CONSEQUENCES FOR STUDY OF TOLERANCES AND DISTRIBUTION OF HF LOSSES Ph.D. Thesis
Francois Foret Jul. 1971 57 p refs In FRENCH
(LYCEN-7149) Avail: NTIS Avail: AEC Depository Libraries

Problems related to the construction of the accelerating cavity of the heavy ion linear accelerator of Lyon were studied. The effect of the variation of different geometrical parameters on the distribution law of the accelerating field was analyzed, and the geometrical limits were deduced from this analysis. The currents in the drift tube supports and in the walls were studied. The electromagnetic field in some interesting regions of the device was measured in order to determine the maximum permissible electric field in an accelerating gap. The accelerating field was generally limited by breakdown phenomena, but for an interdigital H structure, cooling may be the limiting factor since the power dissipated in the support is very high. NSA

N72-23700# Brookhaven National Lab., Upton, N.Y.
LOW TEMPERATURE PROPERTIES OF THE KONDO HAMILTONIAN
V. J. Emery and A. Luther Jan. 1972 5 p refs Presented at 17th Ann. Conf. on Magnetism and Magnetic Mater., Chicago, 16 Nov. 1971
(BNL-16411; Conf-711108-11) Avail: NTIS HC $3.00

The low temperature Kondo problem is solved by extending a method used on the ground state to finite temperatures. The ground state magnetization was found to vanish only when the longitudinal s-d exchange is antiferromagnetic, to all orders in perturbation theory. The zero temperature $T=0$ susceptibility is then finite, and the leading temperature correction proportional to T squared. The specific heat is linear in T. The dependence of the susceptibility and specific heat on the transverse exchange is determined from exact homogeneity properties of the free energy. Author

N72-23701# Argonne National Lab., Ill.
APERTURE CURRENTS AND PROBE RESPONSES FROM ELECTROMAGNETIC TESTS
Cyrus W. Cox Aug. 1971 19 p refs
(Contract W-31-109-eng-38)
(ANL-7831) Avail: NTIS

A mathematical validation is presented for representing apertures and defects in conductors as current sources when excited by massive externally pulsed fields. The current distribution contributed by a cylindrical void in a conductor is derived, and the result is used to approximate the flux that links a pickup coil, the rim of which passes over an aperture. The concept of defect current is used to estimate the form of the response of a scanning mask aperture probe passing over a defect.
Author (NSA)

N72-23702# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
THEORY OF A NONCOLLINEAR FERROMAGNETISM OF THE U3X4 COMPOUNDS
J. Przystawa (Wroclaw Univ., Poland) and E. Praveczki (Central Res. Inst. for Phys., Budapest) 1971 32 p refs Submitted for publication
(JINR-E4-6089) Avail: AEC Depository Libraries

A model was devised based on the symmetry considerations describing the behavior of the U3P4 system in an external magnetic field. The supposed magnetic structure of U3P4 is described in terms of magnetic symmetry groups. A microscopic Hamiltonian is proposed, which is invariant with respect to the symmetry operations of R3 c prime group, which contains the three-axial crystal field anisotropy, the uniaxial exchange anisotropy and usual exchange isotropic interaction. The behavior of the system was considered along an external magnetic field directed along the /111/ axis. The asymptotic behavior of the magnetization at fields tending to infinity and initial susceptibility were also studied. Author

N72-23703# Joint Inst. for Nuclear Research, Dubna (USSR).
STABILIZATION OF THE KINK INSTABILITY OF THE TWO-COMPONENT RELATIVISTIC RING BY AN AZIMUTHAL MAGNETIC FIELD
A. G. Bonch-Osmolovskii and K. A. Reshetnikova 1971 8 p refs In RUSSIAN
(JINR-P9-6136) Avail: AEC Depository Libraries

The kink instability is considered for the case of an azimuthal magnetic field. It is shown that, at sufficiently high values of the magnetic field, the stability regions are changed. In particular, the instability can be stabilized at significant beam densities. Author (NSA)

N72-23704# Rutherford High Energy Lab., Chilton (England).
SUPERCONDUCTING PULSED MAGNETS FOR A 1000-GeV SYNCHROTRON
D. B. Thomas Sep. 1971 17 p refs Presented at 8th Intern. Conf. on High Energy Accelerators, Geneva, 20-24 Sep. 1971
(RPP/A-87; Conf-710908-7) Avail: AEC Depository Libraries

The state-of-the-art is described, in particular the preliminary testing of the superconducting dipole of representative aperture. Future plans include the construction and testing of a fully engineered version of this magnet, representatives in all respects except one (length) of that required for a 1000 GeV conversion of the European 300 GeV machine. This magnet is scheduled for completion in 1973. Author (NSA)

N72-23705# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
TRANSFORMATION PROPERTIES UNDER BROKEN SYMMETRY
M. Bace 29 Dec. 1971 28 p refs Submitted for publication
(Contract AT(30-1)875)
(UR-875-368) Avail: NTIS

A general condition is derived which allows a local field (in an arbitrary field theory) to belong simultaneously to a fixed representation of the Lorentz group and a given representation of a broken symmetry group. Specializing to local currents one obtains the condition of Gross and Jackiw for a complete current algebra, the condition Beg et al. for the dimension of a current component to be independent of its Lorentz index, and the condition necessary for covariant derivatives in broken chiral theories to be covariant. Also, one is able to understand observations of Kimel on the failure of complete current algebra in gauge field models with mass-breaking terms, those by Takahashi and others on the impossibility of assigning a dimension to Duffin-Kemmer scalar and Klein-Gordon vector fields, and some other specific results. The above condition allows a critical examination of operator product expansions. The point of the research is in its generality; it makes possible a unified view of a large number of specific results and observations. Author (NSA)

N72-23706# California Univ., Livermore. Lawrence Livermore Lab.
ACOUSTIC EMISSION RELATED TO NONDESTRUCTIVE TESTING
C. A. Tatro 22 Sep. 1971 24 p refs Presented at SAE Natl. Automotive Eng. Congr. and Exposition, Detroit, 10-14 Jan. 1972 Submitted for publication Sponsored by AEC
(UCRL-73441-Rev-1; Conf-720106-1) Avail: NTIS

The characteristics of acoustic emission as they bear on applicability to nondestructive testing are emphasized. Among the advantages anticipated for the acoustic emission method are: (1) moving inspection upstream in the production process, so that bad production can be eliminated before large fabrication and assembly costs are accumulated, and (2) economical 100% NDT inspection of finished components or products. Author

N72-23707# Hughes Aircraft Co., Fullerton, Calif.
NEARFIELD RADIATED NOISE STUDY
Donald A. Murphy 30 Dec. 1971 53 p
(Contract N00014-69-C-0034)
(AD-736699; FR-72-11-6) Avail: NTIS CSCL 17/1

The study consists of three related parts. Each part deals with some aspect of radiated noise measurement in which the measurement can be in the near field of the source or the combination of the source and its surface image. In the first part the estimation of far field pressure waveform is examined to determine the dependence of the estimator upon the nature of the source. In the second the effect of surface image interference upon the estimate of radiated noise intensity mean and variance is investigated. In the third part the dependence of the spectrum measurement upon the position in the field of the source is shown to be significant. Author (GRA)

N72-23708# Wyle Labs., Inc., Huntsville, Ala.
PREDICTION OF EXCESS ATTENUATION SPECTRUM FOR NATURAL GROUND COVER Interim Technical Report
S. P. Pao Feb. 1972 94 p refs
(Contract DAHC04-70-C-0016)
(AD-736844; WE-72-3; AROD-8871-3-E) Avail: NTIS CSCL 20/1

A mathematical model was applied to the prediction of sound absorption over various types of ground cover composed of natural vegetation. The physical structure and relevant mechanical properties of ground cover canopies were determined. The acoustical properties of the ground cover itself was also estimated. Author (GRA)

N72-23709# Air Force Cambridge Research Labs., L. G. Hanson Field, Mass.
BACKEMISSION OF ELECTRONS FROM METALS IRRADIATED BY 0.2 MeV TO 1-4 MeV ELECTRONS
A. R. Frederickson and A. Mathewson 22 Sep. 1971 46 p refs
(AD-736796; AFCRL-71-0514; AFCRL-PSRP-463) Avail: NTIS CSCL 20/3

Low-energy and high-energy electron yields have been measured from Al, Cu, Ta, and Pb targets bombarded by 0.2 MeV to 1.4 MeV electrons. An improved apparatus, the hemispherical triode, is shown to be very effective in measuring the total yield of high and low energy electrons. The low-energy yields measured with the hemispherical triode are significantly less than the low-energy yields previously reported in the literature. The reasons for the improvement in data are discussed and experimentally verified. The improved data can be used to determine the energy deposition at the surface of the metal targets. The data also shows a strong dependence on the target surface texture; this dependence is briefly studied. Author (GRA)

N72-23788*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
THERMOPHYSICAL PROPERTY DATA AND SAFETY INFORMATION
R. H. Kropschot *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 31-44 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

N72-23791*# TRW Systems Group, Houston, Tex.
A NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR SUPERCRITICAL FLUID THERMODYNAMIC ANALYSIS
P. J. Heinmiller *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 130-181 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

N72-23792*# Bellcomm, Inc., Washington, D.C.
HEAT TRANSFER AND THERMAL STRATIFICATION IN THE APOLLO 14 CRYOGENIC OXYGEN TANKS
S. S. Fineblum, A. S. Haron, and J. A. Saxton *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 182-204 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

N72-23794*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STRATIFICATION CALCULATIONS IN A HEATED CRYOGENIC OXYGEN STORAGE TANK AT ZERO GRAVITY
John T. Shuttles and G. Louis Smith *In its* MSC Cryog. Symp. Papers May 1971 p 233-273 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

N72-23795*# North American Rockwell Corp., Downey, Calif. Space Div.
PREDICTION OF THE EFFECTS OF THERMAL STRATIFICATION ON PRESSURE AND TEMPERATURE RESPONSE OF THE APOLLO SUPERCRITICAL OXYGEN TANK
I. M. Chen and R. E. Anderson *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 274-300 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

N72-23796*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE CRYOGENICS ANALYSIS PROGRAM FOR APOLLO MISSION PLANNING AND ANALYSIS
Walter Scott and Jack Williams (Lockheed Electronics Co., Houston, Tex.) *In its* MSC Cryog. Symp. Papers May 1971 p 301-330 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

N72-23797*# TRW Systems Group, Houston, Tex.
APOLLO CRYOGENIC INTEGRATED SYSTEMS PROGRAM
R. K. M. Seto and J. E. Cunningham *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 331-406 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

N72-23799*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A REVIEW OF CRYOGENIC TESTING PERFORMED BY THE THERMOCHEMICAL TEST BRANCH, MANNED SPACECRAFT CENTER IN SUPPORT OF APOLLO 13 AND 14
Clarence E. Propp and John M. McGee *In its* MSC Cryog. Symp. Papers May 1971 p 433-454 ref (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

N72-23801*# General Electric Co., Houston, Tex. Apollo and Ground Systems.
TESTING AND CONTROL OF MATERIALS USED IN HIGH PRESSURE OXYGEN CRYOGENIC SYSTEMS
R. P. Segrest *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 475-487 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N72-23710 Brandeis Univ., Waltham, Mass.
PROPERTIES OF A SHORT RANGE FIELD MODEL OF SUPERDENSE MATTER Ph.D. Thesis
Shu Tim Lai 1971 152 p
Avail: Univ. Microfilms Order No. 71-20337

An equation of state was obtained for ultrahigh density matter for baryons interacting via a repulsive short range vector field. Correlation effects were treated by means of a fluctuation-dissipation approach and also by the Ring approximation of the Ursell-Mayer cluster expansion. It is shown that in the domain of ultrahigh density plasma, correlation effects do not dominate over both kinetic and Hartree terms, and the speed of sound is subliminal. For parameters continued beyond the plasma domain, correlation effects may dominate, possible phase transitions are present, and the speed of sound approaches c, the velocity of light in vacuo. Correlations beyond the Ring approximation were calculated summing melon-type cluster diagrams. Dispersion relations of the lattice model and the continuum model are compared. Properties of ferromagnetic transitions of the short range vector field model were obtained in a Hartree-Fock approximation with plane wave states.
Dissert. Abstr.

N72-23711 Tennessee Univ., Knoxville.
INTERACTION OF A MONOENERGETIC ARGON MOLECULAR BEAM WITH A SOLID ARGON SURFACE Ph.D. Thesis
Michael Ray Busby 1970 135 p
Avail: Univ. Microfilms Order No. 71-17718

An aerodynamic molecular beam and phase sensitive detection system were used to investigate the spatial distributions of argon atoms scattered from solid argon for: incident beam energies of 0.3, 0.37, 0.43, and 0.5 electron volts incident angles (measured with respect to the surface normal) of 0 to 70 degrees; and solid argon temperatures of 13.5 K. The effect of surface temperature on the distributions for 0.5 electron volt beams at 70 incidence was studied in the range 13.5 to 23 K. Both in-plane and out-of-plane spatial distribution measurements were made, and highly non-diffuse supraspecular flux distributions were observed for the non-condensing atoms. The experimental data indicated that the angle of maximum reflected intensity was independent of the beam intensities, beam energies, beam incidence angles, and surface temperatures investigated; and its value was approximately 75. Dissert. Abstr.

N72-23712*# Brown Univ., Providence, R.I.
FIELD DEPENDENCE OF GASEOUS ION MOBILITY: TEST OF APPROXIMATE FORMULAS
Hong-sup Hahn and E. A. Mason [1972] 25 p refs
(Grant NGL-40-002-059)
(NASA-CR-126394) Avail: NTIS HC $3.25 CSCL 20H

The accuracies of three approximate formulas were tested by comparison with special cases for which accurate results could be found. The Wannier free flight theory was found to be superior, and can be extended to yield a formula without further adjustable constants that gives an exact result at low electric fields and good results at medium and high fields. It is applicable for any ion neutral force law and mass ratio. Author

N72-23713# Atomic Energy Commission, Washington, D.C. Office of Information Services.
INNER SPACE: THE STRUCTURE OF THE ATOM

Samuel Glasstone 1972 102 p refs
(LC-75-184202) Avail: NTIS HC $7.25; USAEC, Technical Information Center, P.O. Box 62, Oak Ridge, TN 37830

A history of investigations into the structure of the atom is presented. Theories and research are discussed, on the topics of atomic structure, the orbital electrons, and the nucleus. K.P.D.

N72-23714# Arkansas Univ., Fayetteville.
NUCLEAR AND COSMOCHEMISTRY Final Report, 1 May 1964 - 31 Oct. 1971
P. K. Kuroda Oct. 1971 5 p
(Contract AT(40-1)-3235)
(ORO-3235-75) Avail: NTIS HC $3.00

The activities during the period 1964 to 1971 are discussed. Experimental evidence for the Pu-244 hypothesis was obtained in 1965, and the occurrence Pu-244 in the early solar system is now generally accepted. The occurrence of the element 61, promethium, in a sample of pitchblende from the Congo was demonstrated in 1968. A method for the determination of the temperature of the sun's core was proposed in 1971. A tentative value of 8,000,000 degrees K was obtained for the temperature of the sun's core during its deuterium-burning stage. The following isotopes and isomers were discovered: 13.7-sec As-82; 42-sec Ge-79; 34-sec Rh-110; 6.1-sec Pr-150; 5.8-min Lu-180; 1.5 sec In-122; 26-sec Co-63; 0.40-sec Co-64; 3.8-min Cu-68m; 3.0-sec Mn-58m; 4.0-sec Au-204; and 50-sec Ni-67. Decay schemes of these and other neutron-rich unstable nucleides were elucidated. Systematic studies were carried out on the spontaneous and fast-neutron-induced fission mass yields, as well as the trends in the (n,p) and (n,alpha) across section values. Author

N72-23715# Los Alamos Scientific Lab., N.Mex.
NEUTRON DIFFRACTION STUDIES ON DySb, NdSb, AND CeSb
Norris Nereson and Vernon Struebing [1971] 5 p refs
Presented at Conf. on Magnetism, Chicago, 16 Nov. 1971
Sponsored by AEC
(LA-DC-12885; Conf-711108-3) Avail: NTIS

Neutron diffraction data from powder samples of DySb, NdSb, and CeSb confirm antiferromagnetic ordering below Neel temperatures of 12, 16, and 18 K. The magnetic cell of DySb has dimensions twice that of the chemical cell; a possible antiferromagnetic structure has spins ferromagnetically aligned in each (111) magnetic plane, with the spins in adjacent (111) planes having opposing directions. The NdSb magnetic cell has tetragonal symmetry and the same lattice constant as the cubic chemical cell. The antiferromagnetic arrangement has ferromagnetic sheets parallel to the (001) planes with the spin direction /001/ alternating from one layer to the next. The ordered moments in DySb and NdSb are given. The CeSb magnetic reflections can be indexed as a modulated wave propagating along the /110/ direction with a wavelength of 2.7a sub 0 or 17.5 + or - 0.5 A. All of the CeSb magnetic reflections do not conform to a simple modulated structure. Author (NSA)

N72-23716# Edgerton, Germeshausen and Grier, Inc., Goleta, Calif.
EFFECTS OF THICKNESS, ABSORBED DOSE RATE AND TOTAL DOSE ON PLASTIC SCINTILLATOR LIGHT EMISSION
J. Stevens, H. S. Janee, and W. John Jun. 1972 81 p refs
Prepared for Los Alamos Scientific Lab.
(Contract AT(29-1)-1183)
(EGG-1183-2264) Avail: NTIS HC $6.25

The transient light emission of the NE102 plastic scintillator was measured as a function of the energy per unit volume impinging on the scintillator, for various values of scintillator thickness and exposure times. The results were compared to light emission from a Lucite Cherenkov radiator. At high absorbed dose rates the scintillators were found to become nonlinear, but the degree on nonlinearity was also found to depend on total dose. Thicker scintillators were found to display a greater degree of nonlinearity at the same value of absorbed dose rate; this effect was dependent on the total absorbed dose and may have been due to light attenuation. Because of the dependence between absorbed dose and exposure dose on thickness, the threshold for nonlinearity in terms of exposure dose decreased rapidly as scintillator thickness increased. Author (NSA)

N72-23717# Los Alamos Scientific Lab., N.Mex.
ICONS AT LASL: A PROPOSAL TO THE AEC DIVISION OF BIOLOGY AND MEDICINE FOR THE PRODUCTION AND USE OF SEPARATED ISOTOPES OF CARBON, OXYGEN, NITROGEN, AND SULFUR
R. E. Schreiber (ed.) Sep. 1971 18 p refs
(Contract W-7405-eng-36)
(LA-4759) Avail: NTIS HC $3.00

A plan to augment capabilities in the separation and use of stable isotopes of C, O, N, and S (ICONS) is discussed. The broad objective is to assess the potential of ICONS in basic chemistry, biology, medicine, agriculture, environmental improvement, and any area in which the ability to trace a material containing carbon, oxygen, or nitrogen is of value. Since the ICONS are stable, many applications can be made in which there would be both technical and political problems in using radioactive tracers. NSA

N72-23718# Joint Inst. for Nuclear Research, Dubna (USSR).
NEW NEUTRON-DEFICIENT ISOTOPE Ru 92
R. Arlt, B. Bayar, B. Kratsik, A. F. Novgorodov, F. Severa, Tran Thanh Minh, and N. G. Zaitseva 1971 13 p refs
(JINR-E6-6107) Avail: AEC Depository Libraries

The growth and decay of gamma lines of the daughter isotope Tc-92 and the direct decay of Ru-92 were observed. The half-life of the Ru-92 isotope was determined to be T sub 1/2 = (3.16 + or - 0.33) min. The energies and relative intensities of the Ru-92 gamma rays are: (134.68 + or - 0.09) keV (57 + or - 8), (213.94 + or - 0.11) keV (84 + or - 13), and (259.41 + or - 0.09) keV (100). Author (NSA)

N72-23719# Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.
[NUCLEAR PHYSICS RESEARCH] Annual Report, 1970
P. K. Iyengar, ed. and N. S. Satya Murthy, ed. 1971 123 p refs
(BARC-557) Avail: AEC Depository Libraries

A summary of research is given on nuclear, solid-state, and reactor neutron physics, seismology, and development of special nuclear instruments. A list of publications is included. NSA

N72-23720# Du Pont de Nemours (E. I) and Co., Aiken, S.C. Savannah River Lab.
NEUTRON SOURCES AND APPLICATIONS, VOLUME 1
Aug. 1971 326 p refs Presented at Am. Nucl. Safety Soc. Natl. Topical Meeting, Augusta, Ga., 19-21 Apr. 1971
(Contract at(07-2)-1)
(Conf-710402-Vol-1) Avail: NTIS

Neutron sources are studied applied to forensic science, pollution control, extraterrestrial investigations, ground water hydrology, industrial radiography, and actinium-beryllium compounds. Neutrons were also applied in the biological field, such as autoradiography of bone, iron utilization measurement in pregnant women, radiocobalt retention determinations, metabolic bone diseases, red cell kinetics, and production of tracers and radiopharmaceuticals. J.A.M.

N72-23721# Oregon State Univ., Corvallis. Dept. of Physics.
THEORETICAL NUCLEAR STRUCTURE STUDIES FOR LIGHT NUCLEI Final Report
David V. Grillot 30 Jan. 1972 12 p refs
(Grant AF-AFOSR-1720-69; AF Proj. 9751)
(AD-737364; AFOSR-72-0393TR) Avail: NTIS CSCL 20/8

Three areas of nuclear structure calculations are described for light nuclei. Effective N-N interactions were computed using both the potential and phase-shift method. A doubly self-consistent Hartree-Fock calculation was performed using the computed effective interactions. No significant improvement was obtained for the binding energy per nucleon. The effective Hamilton formalism for a truncated space was examined and instabilities in the method was observed. Author (GRA)

N72-23344*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUGER ELECTRONS
Lo I. Yin *In its* Significant Accomplishments in Sci., 1970 1972 p 103-106 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 20H

N72-23365*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MUON PRODUCTION
Kaichi Maeda *In its* Significant Accomplishments in Sci., 1970 1972 p 212-216 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 20H

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N72-23722*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STATIONARY COLLECTOR IN A COLLISIONLESS PLASMA
J. M. Grebowsky Apr. 1972 13 p refs Submitted for publication
(NASA-TM-X-65872; X-621-72-89) Avail: NTIS HC $3.00 CSCL 20I

The effect of a neutral collecting body in a collisionless plasma on the plasma distribution in its immediate neighborhood is discussed. When a magnetic field is present an electron plasma with a neutralizing background charge has empty velocity space regions at points near a collector even though the distribution is Maxwellian far from the collector. For a thin cylinder, the collected collisionless plasma current is a function of the angle between the cylinder axis and the magnetic field with the minimum current collected when the cylinder and field lines are parallel. Author

N72-23723*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A NEW METHOD FOR IN SITU ELECTRON TEMPERATURE DETERMINATIONS FROM PLASMA WAVE PHENOMENA
Hiroshi Oya and Robert F. Benson Apr. 1972 15 p refs Submitted for publication
(NASA-TM-X-65881; X-621-72-112) Avail: NTIS HC $3.00 CSCL 20I

A discrepancy has been reported between the values of the electron temperature t sub e deduced from satellite electrostatic probe measurements and ground based radar backscatter measurements. This discrepancy (radar backscatter temperature less than the probe temperature) is not present when the probe experiment is flown on a rocket to lower altitudes but reappears when the rocket probe attains higher altitudes. There is a need for an independent radio wave method for making in-situ t sub e measurements in order to help resolve this problem. A new method of determining t sub e from the satellite resonant phenomena is presented. It is based on the splitting (observed at high latitudes) of the diffuse resonance which occurs at the frequency f sub d1 between f sub h and 2 f sub h. The advantage of this method over the other methods involving ionospheric resonances is the simplicity of the required calculations. There is, however, the limitation of plasma conditions where the f sub d1 resonance can be observed and the limitation to mid-to-high latitudes where the splitting is observed. Author

N72-23724*# Humphreys Corp., Concord, N.H. TAFA Div.
INDUCTION TORCHES AND LOW FREQUENCY TESTS
John W. Poole and Charles E. Vogel Washington NASA May 1972 41 p refs
(Contract NAS3-14423)
(NASA-CR-2053) Avail: NTIS HC $3.00 CSCL 20I

Three induction-coupled plasma torches were operated at 9600 Hz to determine specific operating parameters and supply data for gas core nuclear rocket simulation studies. Two air-cooled torches, one 16 cm in diameter and one 30 cm in diameter, and a water-cooled torch 14 cm in diameter, were tested. Complete energy balances for the operating systems were obtained during operation. A series of operating points, including pressures from 30 torr to 1 atmosphere, power levels up to 343 kw, and gas flows from 1.1 to 35 g/sec, were documented. Complete operating data for approximately thirty runs are presented, along with graphs of significant operating parameters. Author

N72-23725# California Univ., Berkeley. Lawrence Radiation Lab.
LIGHT SCATTERING BY ION THERMAL FLUCTUATIONS IN A DENSE PLASMA Ph.D. Thesis
Dennis A. Reilly 1 Jun. 1971 128 p refs
(Contract W-7405-eng-48)
(UCRL-20815) Avail: NTIS

Laser scattering at 90 deg is used to obtain a local, detailed mapping in space and time of plasma development in a dense, relatively cold sheet pinch in deuterium gas. The observed plasma scattering parameter, alpha, covers a range between 0.5 and 2.0 with plasma electron densities between 3 times 10 to the 15th power to less than 10 to the 17th power per cubic centimeter temperatures between 0.5 and 3 electron volts, and with gross plasma velocities up to 2 cm/microseconds. A numerical method for reducing scattering data is presented. Plasma parameters along with expected errors are deduced from each laser shot, with each spectral channel weighted according to its measured statistics and with full account being taken of the finite spectral width of both the laser and the spectrum measuring channels. Author (NSA)

N72-23726# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
ACCELERATION OF A GASEOUS PLASMA BY INTENSE MICROWAVE FIELDS IN A CONSTANT INHOMOGENEOUS MAGNETIC FIELD Ph.D. Thesis - Paris Univ., Orsay
Georges Mourier Nov. 1971 155 p refs In FRENCH
(CEA-R-4149) Avail: AEC Depository Libraries

The large amplitude electric field excites, in a constant inhomogeneous magnetic field, a plasma near electron cyclotron resonance. These particles are accelerated to energies of between 100 and 10,000 eV and subsequently drift to the regions of lower magnetic field. The ions are accelerated by the resulting electrostatic forces. Ion and electron currents of some tens of milliamperes to a few amperes are obtained. The energy of the electrons is limited by their relativistic mass: a three-dimensional spacecharge model is set up to describe the particle flow. Author (NSA)

N72-23727# Los Alamos Scientific Lab., N.Mex.
NUMERICAL CALCULATION OF THE THETA, Z, AND SCREW PINCHES
Albert Haberstitch Dec. 1971 23 p refs
(Contract W-7405-eng-36)
(LA-4782) Avail: NTIS HC $3.25

A one-dimensional MHD program for the computation of cylindrical theta, z, and screw pinches is formulated. The theta

pinch is assumed to be driven by a current of known magnitude, while the z pinch is driven either by a known current or by an external LC circuit. The calculations make use of the equations of motion and continuity, the generalized Ohm's law, separate energy equations for the ions and electrons, and Maxwell's equations. Included are the ion and electron heat conductivities, the equipartition time, the Richtmyer-Von Neumann artificial viscosity, an electrical resistivity tensor, and an optional thermoelectric effect. The case of a biased z pinch with both classical and anomalous resistivity is examined. Author (NSA)

N72-23728# California Univ., Berkeley.
AEC PORTION OF THE PLASMA Semiannual Progress Report, 1 Jan. - 30 Jun. 1971
30 Jun. 1971 48 p refs
(Contract AT(04-3)-34)
(UCB-34-P-128-X-1) Avail: NTIS HC $4.50

An impurity mixing experiment to observe the effects and to try to verify the theory for the impurity mixing instability is described. Changes in the apparatus during this period, along with probe characteristics and experimental measurements of density, noise, and oscillation, are reported. Further research work on computer simulation of plasma heating processing is described. The meaning attached to the beam-plasma parameter, PE sub beam KE sub plasma is equal S, is investigated. Computer simulations of ion heating by RF modulated electron beams are analyzed. Finally, properties of simulation plasmas are discussed. NSA

N72-23729# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
DIFFUSION INDUCED BY AN OSCILLATING ELECTROMAGNETIC FIELD IN A TOKOMAK CONFIGURATION
A. Samain 1971 5 p ref Presented at the Conf. on Plasma Theory, Kiev, 19-23 Oct. 1971
(CEA-CONF-1849; Conf-711061-4) Avail: AEC Depository Libraries

The particle and heat diffusions induced by an oscillating electromagnetic field in a Tokamak configuration were studied. Angular and action variables were used to describe the motion of the particles in the static field and general formulas were developed for the coefficients of the transfer induced by the oscillating field and the power gained by the plasma; the particles interacting irreversibly with the oscillating field are either freely circulating or trapped. This formalism was used to study the control of particle diffusion across the configuration and ultimately the refueling of a fusion reactor. A plasma in the Galeev-Sagdeev region I was considered, neoclassical diffusion being assumed. The most promising aspect is the very-low-frequency compressional magnetic pumping of trapped particles. The refueling of a reactor might be possible using this method, the power dissipated in the plasma being much smaller than the natural plasma energy losses. NSA

N72-23730# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Plasmaphysik.
ELECTROSTATIC OSCILLATIONS IN AN INHOMOGENEOUS PLASMA
R. H. Hirsch Aug. 1971 40 p refs
(JUL-781-PP) Avail: AEC Depository Libraries

A numerical solution of the nonlinear Vlasov equation in one dimension is carried out by the Fourier-Fourier transformation method for the case of an inhomogeneous plasma. The initial electron distribution function consists of a background Maxwellian plasma plus two Maxwellian bumps, which appear only in the central region of the plasma. The magnitude of the bumps is linear functions of x within this central region, having a maximum strength D at the center. The ions are assumed immobile and are chosen so that, at t = 0, the plasma is neutral. Perfectly reflecting walls are used as boundary conditions at x = 0 and L. The linear equation is also solved numerically and compared with the linear solution obtained by the method of Landau poles. The macroscopic variables of density N (x,t) average velocity V(x,t) and pressure P (x,t) are recovered at specified time intervals. The microscopic movement of particles is also followed and plotted as the difference between the initial and t = t sub o distribution functions. Author (NSA)

N72-23731# Academy of Sciences (USSR), Moscow.
NONLINEAR TRANSPARENCY OF A LASER PLASMA
G. S. Voronov, N. P. Donskaya, and A. D. Smirnova 1971 8 p refs In ENGLISH and RUSSIAN
(NP-19158) Avail: AEC Depository Libraries

It is found experimetally that the observed dependence of the energy of the ions in a laser plasma on the intensity of radiation differs from the theoretical dependence based on the mechanism of absorption by inverse bremsstrahlung. The sign of this dependence corresponds to nonlinear transparency. Possible mechanisms for this phenomena are discussed. Author

N72-23732# Los Alamos Scientific Lab., N.Mex.
RESONANT ABSORPTION OF LASER LIGHT BY PLASMA TARGETS
J. P. Freidberg, R. W. Mitchell, R. L. Morse, and L. I. Rudsinski Dec. 1971 5 p refs
(Contract W-7405-eng-36)
(LA-4852) Avail: NTIS

It is proposed that a resonant mechanism should cause significant absorption of energy from intense laser pulses in plasma targets and, furthermore, that the energy should be deposited in such a way as to form a non-Maxwellian high temperature tail on the electron velocity distribution.
Author (NSA)

N72-23733# Transtek Associates, Reading, Mass.
ENERGY BALANCE IN DEVICES OF THE TOKAMAK TYPE CONSIDERING CHARGE EXCHANGE
Yu. N. Dnestrovskii, D. A. Kostomarov, and N. L. Pavlova Nov. 1971 52 p refs Transl. into ENGLISH from the Russian report Prepared for Princeton Univ.
(Contract AT(30-1)-1238)
(MATT-Trans-107) Avail: NTIS

Within the framework of a phenomenological description, a study is made of various models of the anomalous nature of plasma resistance and thermal conductivity. Author (NSA)

N72-23734# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.
TIME FLUCTUATIONS OF TEMPERATURE IN A MAGNETOHYDRODYNAMIC PLASMA
E. M. Murray 24 Jan. 1972 83 p refs
(Contract W-7405-eng-26)
(Y-1797) Avail: NTIS

An experimental investigation of the temperature of a potassium-seeded magnetohydrodynamic plasma was performed. The main means of obtaining temperature measurements incorporated an apparatus which contains two photomultiplier tubes that sensed light intensity fluctuations from the plasma. The plasma temperature, Hall voltage, and static pressure parameters of a Hall generator were analyzed for functional dependence of one parameter on another. Two separate temperature measurement techniques were utilized in this experimental investigation: (1) measuring the electrical conductivity of the plasma from the Hall channel from which a temperature measurement was obtained, and (2) incorporating the ratio of the outputs of both the photomultiplier tubes and a mathematical derivation from Planck's black body radiation law to obtain a temperature determination. Voltage signals from equipment sensing the plasma parameters were recorded and the autocorrelation and cross correlation functions were determined. Author (NSA)

N72-23735# Oak Ridge National Lab., Tenn.
COUPLING OF TRANSVERSE WAVES TO ELECTROSTATIC MODES IN A MAGNETIZED PLASMA

J. D. Callen and G. E. Guest Jan. 1972 57 p refs Submitted for publication
(Contract W-7405-eng-26)
(ORNL-TM-3671) Avail: NTIS

The complete dispersion relation governing longitudinal and transverse waves in an infinite, homogeneous, magnetized plasma is discussed for arbitrary directions of wave propagation. Various forms suitable for computing modifications of the electrostatic dispersion relation arising from the coupling to transverse waves are compared. The modifications that arise for electrostatic-ion gyroharmonic instabilities are determined in an ordering scheme appropriate for the important unstable modes of a mirror-confined thermonuclear plasma. The resultant effects on a number of electrostatic modes are discussed. Author (NSA)

N72-23736# Institut Franco-Allemand de Recherches, St. Louis (France).
STUDY OF THE EFFECTS OF INTENSIVE LASER PULSES ON THIN FILMS USING THE TWO WAVELENGTH INTERFEROMETER [UNTERSUCHUNG DES VERHALTENS DUENNER SCHICHTEN UNTER EINFLUSS INTENSIVER LASERIMPULSE MIT HILFE DER ZWEIWELLENLAENGEN-INTERFEROMETRIE]
M. Hugenschmidt and K. Vollrath 2 Sep. 1970 24 p refs In GERMAN Presented at the Meeting on the Phys. of High Speed Phenomena, Munich, 16 Mar. 1970
(Contract T/0260/02630/01055)
(ISL-8/70) Avail: NTIS HC $3.25

Differential interferometry was used to investigate the effects of an intensive neodymium laser pulse when focused upon a thin graphite layer. The 1.6 micron thick graphite layers were deposited on a glass substrate. The plasma propagation on the side opposite to the incident illumination and in the direction of the laser ray wave vector was examined. The plasmas expand in air under normal pressure and room temperature. The interferometer's light source was a ruby laser. The resulting electron and neutral particle density distributions inside the volume are bounded by the shock wave. Author (ESRO)

N72-23737# Institut Franco-Allemand de Recherches, St. Louis (France).
INTERFEROMETRIC STUDY OF HIGH SPEED PROPAGATING PHASE OBJECTS USING THE FUNDAMENTAL WAVE AND THE SECOND HARMONIC OF A RUBY LASER [INTERFEROMETRISCHE UNTERSUCHUNG SCHNELL VERAENDERLICHER PHASENOBJEKTE MIT HILFE DER GRUND- UND OBERWELLE EINES RUBINLASERS]
M. Hugenschmidt and K. Vollrath 2 Sep. 1970 28 p refs In GERMAN Presented at the 9th Intern. Congr. on High Speed Phot. and Cinematog., Denver, 1970
(Contract T/0260/02630/01095)
(ISL-10/70) Avail: NTIS HC $3.50

A differential interferometer and a ruby laser were used to diagnose phase objects with frequency dependent refractivity, such as in ionized plasmas. The instruments provide sufficient separation for the two perpendicularly polarized ray systems. A Q-switched ruby laser's ground wave and second harmonic were the incident light beams. The evaluation of cylindrical or spherical refractivity profiles, separated in two wavelengths, is possible. Some applications of the interaction of intensive laser radiation with solid state objects and gases, as well as existing plasmas, are shown. Author (ESRO)

N72-23738# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
EFFECTS OF COLLISIONS AND GYROVISCOSITY ON GRAVITATIONAL INSTABILITY IN A TWO-COMPONENT PLASMA
Franz Herrnegger 28 Dec. 1971 24 p refs
(Contract F61052-70-C-0014; AF Proj. 9752)
(AD-736951; UNICP-SR76; AFOSR-72-0358TR) Avail: NTIS CSCL 20/9

The dispersion relation for gravitational instability is derived within the framework of a two-fluid theory. It is shown that the Jeans criterion is changed by finite Larmor radius effects and by collisions for wave propagating perpendicular to the magnetic field. The critical wavenumber for instability decreases with increasing Alfven velocity and with increasing gyroviscosity. Instability does not set in with overstability. Author (GRA)

N72-23739# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
INVESTIGATIONS ON PLASMA INSTABILITIES Final Scientific Report, 1 Jan. 1970 - 31 Dec. 1971
Ferdinand Cap and Franz Herrnegger 31 Dec. 1971 27 p refs
(Contract F61052-70-C-0014; AF Proj. 9752)
(AD-736835; UNICP-FR71; AFOSR-72-0357TR) Avail: NTIS CSCL 20/9

The report summarizes the research work on plasma instabilities done at the Institute for Theoretical Physics, University of Innsbruck, in the period 1970-1971. The main topics are plasma turbulence, local potential in MHD, nonlinear waves, literature survey on plasma instabilities, collisional kinetic equations gravitational instability, numerical investigation of microinstabilities. Author (GRA)

N72-23740# California Univ., Los Angeles. Plasma Physics Group.
ION HEATING VIA TURBULENT ION ACOUSTIC WAVES
R. J. Taylor and F. V. Coroniti Feb. 1972 22 p refs
(Contract N00014-69-A-0200-4023)
(AD-737228; PPG-111) Avail: NTIS CSCL 20/9

Three dimensional ion acoustic turbulence is excited by injecting a cold ion beam into a non-magnetized plasma with T sub e/T sub i = 5. A rapid, approximately exponential heating of the ion beam is observed along the beam path. The heating rates level off when the ion temperature approaches 0.2 T. The turbulent ion acoustic wave energy density does not exceed 1 to 3 x 10 to the (-9th) power (T sub e). The initial rapid ion beating is accounted for by quasilinear theory. Wave saturation, which occurs before significant dissipation of ion beam energy, is consistent with orbit diffusion string turbulence theory. Author (GRA)

N72-23741# Tel-Aviv Univ. (Israel). Dept. of Applied Mathematics.
DISCONTINOUS MAGNETOFLUIDYNAMIC FLOWS Final Scientific Report
Nima Geffen and Samuel Librai Jun. 1971 39 p refs
(Contract F61052-70-C-0026; F61052-70-C-0015; AF Proj. 975)
(AD-737124; AFOSR-72-0307-TR) Avail: NTIS CSCL 20/9

The paper contains numerical analysis and results of computer simulation for the nonlinear axial flow of a free surface liquid conductor under the influence of a time-varying magnetic field. The analysis is applicable to other physical systems, which can be described as initial value problems for a system of first-order quasi-linear, partial differential equations, possibly non-homogeneous with forcing and friction terms. Results are given for calculations on a fixed mesh by a Lax-Wendroff scheme, including a shock formation, propagation and reflection from the axis of symmetry; also integration along characteristics, for the continuous part of the field until a shock starts to form. In addition, a semi-analytic solution is worked out for the initial characteristic triangle, and its break-down point is estimated. Comparison among results obtained by the different methods is given, and application to configurations of plasma-confinement, astrophysical atmospheric and oceanographic problems pointed out. Author (GRA)

N72-23742# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
INVESTIGATIONS ON THE DYNAMICS OF MHD FLOWS Annual Technical Report, 1 Jan. - 31 Dec. 1971
Horst E. Wilhelm 15 Jan. 1972 102 p refs

(Contract N00014-67-A-0299-0008)
(AD-737289; ATR-3) Avail: NTIS CSCL 20/9

Theoretical investigations on plasmas in MHD flows and energy conversion systems are examined. The spatial development of the boundary layer and the onset of separation in magnetohydrodynamic flows between diverging duct walls is investigated by similarity methods and within the frame of the boundary layer approximation. An analytical solution is presented for the nonlinear initial boundary value problem, describing the diffusion and convection of plasmas in presence of ionization and recombination reactions. A plasma turbulence theory is formulated which is based exclusively on the first principles of classical statistical mechanics. Author

N72-23743# University Coll., Cork (Ireland). Dept. of Electrical Engineering.
MICROWAVE AND SPECTROSCOPIC ANALYSIS OF PULSED AND CONTINUOUS GASEOUS PLASMAS Final Scientific Report, 1 Mar. 1969 - 31 Aug. 1971
M. C. Sexton 15 Nov. 1971 15 p
(Grant EOOAR-0048-69; AF Proj. 9767)
(AD-736953; AFOSR-72-0295TR) Avail: NTIS CSCL 20/9

Microwave and spectroscopic methods were used to analyze afterglow processes in helium, argon, hydrogen, and deuterium plasmas over the electron density range (10 to the 13th power) to (10 to the 10th power)/cc. Simultaneous measurements of electron temperature, density, and gas temperature, confirmed the presence of collisional radiative recombination. The effects of a variable electron radial distribution on the locations of Tonks-Dattner resonances in mercury and rare-gas positive columns were monitored using a dual microwave cavity system. Subsequent measurement of the association electron temperature variation using a low noise radiometer enabled correlation with the radial distribution data to be achieved. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N72-23744*# Hughes Research Labs., Malibu, Calif.
DEVELOPMENT OF ION IMPLANTED GALLIUM ARSENIDE TRANSISTORS Final Technical Report, 22 Dec. 1970 - 22 Dec. 1971
R. Hunsperger and R. Baron Jan. 1972 84 p refs
(Contract NAS1-10503)
(NASA-CR-112037) Avail: NTIS HC $6.25 CSCL 20L

Techniques were developed for creating bipolar microwave transistors in GaAs by ion implantation doping. The electrical properties of doped layers produced by the implantation of the light ions Be, Mg, and S were studied. Be, Mg, and S are suitable for forming the relatively deep base-collector junction at low ion energies. The electrical characteristics of ion-implanted diodes of both the mesa and planar types were determined. Some n-p-n planar transistor structures were fabricated by implantation of Mg to form the base regions and Si to form the emitters. These devices were found to have reasonably good base-collector and emitter-base junctions, but the current gain beta was small. The low was attributable to radiative recombination in the base region, which was extremely wide.
Author

N72-23745# California Univ., Berkeley. Lawrence Radiation Lab.
SURVEY OF RADIATION DAMAGE IN SEMICONDUCTOR DETECTORS
Fred S. Goulding Sep. 1971 20 p refs Presented at Nucl. Sci. Symp., San Francisco, 3 Nov. 1971
(Contract W-7405-eng-48)
(LBL-501; Conf-711111-26) Avail: NTIS HC $3.00

Examples of radiation damage in lithium drifted detectors, lithium drifted silicon detectors, and high purity germanium detectors are discussed. The general patterns of damage, lithium-precipitation, annealing and recovery of detectors are outlined, and the observations are discussed. Author (NSA)

N72-23746# Iowa State Univ. of Science and Technology, Ames.
RADIO-FREQUENCY SIZE EFFECT STUDY OF THE FERMI SURFACE THALLIUM Ph.D. Thesis
Eugene Stanford Takle Nov. 1971 103 p refs
(Contract W-7405-eng-82)
(IS-T-500) Avail: NTIS

The Fermi surface of thallium in the basal plane was studied by use of the radio-frequency size effect technique. In this experiment resonances were observed by measuring the induced frequency changes of a variable frequency oscillator and using the magnetic field modulation technique. Resonances due to open orbits propagating in the (10(-1)0) direction were observed and are used to determine the effective sample thickness to better than 0.1%. Measurements were made on four thallium samples having an estimated residual resistivity ratio (rho sub 273 K)/(rho sub1.2 K) is approximately equal to 100,000. Studies were made of the frequency dependence of the line shapes for several different orbits. These studies were used to determine the appropriate point of the signal complex to choose as the critical field value. An internally consistent Fermi surface model for the basal plane is proposed and is compared with recent theoretical models and other experimental data.
Author

N72-23747# Los Alamos Scientific Lab., N.Mex.
PARAMETER STUDY OF A LONG, SEPARATED SHOCK THETA PINCH WITH SUPERCONDUCTING INDUCTIVE ENERGY STORAGE
F. L. Ribe Dec. 1971 14 p refs
(Contract W-7405-eng-36)
(LA-4828) Avail: NTIS

In the separated shock concept, the shock heating is done by high voltage circuits whose energy content is only a few percent of that of the total system. The compression magnetic energy is contained in a multiturn coil with slow rise time appropriate to adiabatic compression of the plasma in long systems. Physical parameters and costs of a large system were derived. The shock heating was calculated on the basis of plasma sheaths driven by Blumlein transmission lines. The adiabatic compression field was assumed to be energized by a superconducting inductive energy source, switched by normal-going superconductors. Author (NSA)

N72-23748# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
POINT DEFECTS IN REFRACTORY METALS: NIOBIUM, MOLYBDENUM, TITANIUM, AND ZIRCONIUM
R. Pichon, P. Moser, and E. A. Bisogni (Comision Nacional de Energia Atomica, Buenos Aires) 1971 16 p refs Presented at the Intern. Conf. on Defects in Refractory Met., Mol, Belgium, 20-22 Sep. 1971
(CEA-CONF-1886; Conf-710905-3) Avail: AEC Depository Libraries

Internal friction was used to detect and study the behavior of interstitials produced by irradiation in bcc and hcp metals. Simultaneous measurements of electric conductivity and dynamic modulus were also made to clarify the internal friction results. The metals studied included Nb, Mo, Ti, and Zr. The results for Nb showed an impurity-dependent substage at 215 K, which was interpreted by release of interstitials from oxygen traps. There was also evidence that oxygen was trapped by defects induced by neutron irradiation between 410 and 460 K, which was the temperature of stage III electric recovery. In contract to Nb, annealing steps in Mo were similar to fcc metals, which showed a low-temperature Stage I, a continuous Stage II, and a

high-temperature Stage III recovery. Neutron irradiation induced a dynamic modulus change in alpha-Zr and alpha-Ti due to an elastic effect. NSA

N72-23749# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Reaktorphysik.
WORK ON SOLID STATE TRACK DETECTORS [ARBEITEN AN FESTKOERPERSPALTSPURDETEKTOREN]
Gudrun Guenther Aug. 1971 30 p refs In GERMAN; ENGLISH summary
(KFK-1461) Avail: AEC Depository Libraries

Investigations in preparation for routine application of solid state track recorders for measurements in SNEAK are described. A polycarbonate foil (Lexan) was chosen as a detector material satisfying all requirements. In this type of material fission products leave tracks which can be enlarged by etching until they are visible in a light microscope. A simple model of the etching process was compared to experimental results. In order to increase the contrast of the tracks against the background they were finally colored using a felt pen. Author (NSA)

N72-23750# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Inst.
MEASUREMENT OF THE FIGURE OF MERIT OF A SUPERCONDUCTING RESONATOR BY MEANS OF A TRAVELLING WAVE TUBE
A. I. Zykov, B. R. Knyazev, M. I. Kheifets, and A. D. Kuznetsov 1970 12 p refs In RUSSIAN
(KHFTI-70-30) Avail: AEC Depository Libraries

A method of measuring the characteristic Q factor of resonators is described. The schematic of a superhigh frequency modulator is presented and discussed. Measurement of the attenuation decrement of superhigh frequency oscillations was correct to within 1%. Computation of the Q factor for a feed-through resonator is illustrated. Results are given for the calculation of Q factors of resonators with a superconducting lead sheath deposited by cathode sputtering. Author (NSA)

N72-23751# Virginia Univ., Charlottesville.
INVESTIGATION OF DYNAMIC DISLOCATION PHENOMENA IN SINGLE CRYSTALS OF METALS AND ALLOYS Progress Report
John W. Mitchell 15 Oct. 1971 20 p refs
(Contract AT(40-1)-3808)
(ORO-3808-23; PR-3) Avail: NTIS

Development of experimental methods is discussed. Studies were made of plastic deformation phenomena in single crystals with various orientations, as well as dynamic dislocation phenomena in single crystals of alpha phase Cu-Al alloys. A model is presented for the formation of bands of deformation in single crystals of alpha phase Cu-Al alloys. Second and third order elastic constants were measured in these alloys. Author

N72-23752# Brookhaven National Lab., Upton, N.Y.
BROOKHAVEN STUDY OF SUPERCONDUCTING POWER TRANSMISSION CABLES
E. B. Forsyth [1971] 6 p ref Presented at Intern. Conv. and Exposition, New York, 20 Mar. 1972 Sponsored by AEC and NSF
(BNL-16406; Conf-720302-1) Avail: NTIS

An investigation was made of the future growth and requirements in electric power transmission and current research to meet expected need. It seems likely that the ultimate power capability of pipe-type cables is of the order of 2 GVA, and self-contained cables somewhat higher than this. Spacer gas and cryoresistive cables are both competitive in the range 2 to 5 GVA. Two cables designs were investigated. A model of an interleaved ribbon cable was made for hysteretic loss measurements. Loss data was obtained at 60 Hz for niobium tin. Author

N72-23753# Rome Univ. (Italy). Inst. of Physics.
NONLINEAR OPTICAL INVESTIGATION OF POLARITRONS IN SOLIDS
F. DeMartini 6 Oct. 1971 45 p refs Presented at the Symp. on Atomic Structure and Properties of Solids, Varenna, Italy, 5-17 Jul. 1971
(Nota-Interna-339) Avail: NTIS HC $4.25

Nonlinear Raman spectroscopy was used to investigate the excitation and interactions of polaritrons in gallium phosphide semiconductors. Two Raman lasers, pumped by a common Q-switched ruby laser, generated two beams of coherent light at different frequencies which were focused in a crystal of GaP when the polaritron field of different frequency was generated. The first experiment was on a 4-photon polaritron interaction, with detection of the induced excitation via anti-stokes up-conversion of a probing beam in the optical frequency region. In the second experiment the infrared radiation arising from the polaritron wave de-excitation at the exit boundary of the crystal was detected directly outside the medium. Author (ESRO)

N72-23754# Oregon State Univ., Corvallis. Dept. of Chemistry.
PREPARATION OF CRYSTALS OF ALKALINE EARTH OXIDES AND RELATED COMPOUNDS Final Scientific Report
W. J. Fredericks and A. B. Scott 23 Dec. 1971 10 p
(Grant AF-AFOSR-1913-70; AF Proj. 9542)
(AD-736945; AFOSR-71-3131TR) Avail: NTIS CSCL 20/2

Three methods of growing CaO, SrO and BaO single crystals were investigated. The failure of all crucible materials to withstand chemical attack by these oxides when molten prevented the Czochralski technique from working. Vapor phase growth was unsatisfactory due to reaction of the transported material with the growth tube. A plasma torch method in which the oxide powder and the plasma are separately injected into the growth region offers promise, but time available did not permit perfection of this technique. Author (GRA)

N72-23755# New Mexico Univ., Albuquerque. Dept. of Mechanical Engineering.
A STUDY OF ENERGY GENERATION FROM IMPACT ON PIEZOELECTRIC MATERIALS Technical Report, Dec. 1968 - Jul. 1971
R. C. Dove, W. E. Baker, and M. Valathur Kirtland AFB, N. Mex. AFWL Dec. 1971 201 p refs
(Contract F29601-69-C-0023; AF Proj. 5791)
(AD-737102; AFWL-TR-71-118) Avail: NTIS CSCL 19/1

The feasibility of using piezoelectric or ferroelectric materials to generate useful amounts of electrical energy when subjected to impact was investigated. A survey of the current literature in this area was made and abstracts of pertinent articles are included. The basic principles and equations are placed in a form convenient for use in this work and examples given of their application. Significant material properties of common piezoelectric and ferroelectric materials are tabulated. Experimental work on crystals of selected materials was conducted. Static tests were conducted to check the specified piezoelectric coefficients. Two types of dynamic tests were conducted. The first utilized a low pressure shock tube for applying the impulse to the crystal. The second type of dynamic test investigated in depth was one which utilized a split Hopkinson pressure bar for loading the crystals. Author (GRA)

N72-23756# Army Electronics Command, Fort Monmouth, N.J.
MODE CONTROL AND RELATED STUDIES OF VHF QUARTZ FILTER CRYSTALS
Theodore J. Lukaszek 22 Mar. 1971 9 p refs Repr. from IEEE Trans. Sonics Ultrasonics, v. SU-18, no. 4, Oct. 1971 p 238-246 Revised Supersedes AD-719175, dated Nov. 1970
(AD-736758) Avail: NTIS CSCL 09/5

The purpose of this paper, is to present new information which alleviates previously encountered restrictions and permits fabrication of filter crystals to frequencies as high as 200 MHz. This has been made possible on the basis of first, a recently

assembled crystal plating and monitoring system and secondly, the introduction of a new processing method employing ion-etch techniques. Author (GRA)

N72-23757# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
FLUX-FLOW NOISE MEASUREMENTS ON TYPE 2 SUPERCONDUCTORS Final Report
S. W. Shen and A. VanDerziel Jan. 1972 27 p refs
(Contract N00014-67-A-0113-0010; NR Proj. 319-011)
(AD-736640) Avail: NTIS CSCL 20/3

Flux-flow noise in Type 2 superconductors is investigated experimentally. The observed noise turns out to be shot noise as expected from the assumption that the flux-flow voltage is generated by independently drifting flux bundles. Bundle sizes as large as 100 to 100,000 are found in vanadium foils dependent on the bias condition. The experiment shows qualitative agreement with the theory. Author (GRA)

N72-23758# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
THE INFLUENCE OF APPLIED POTENTIAL ON THE MICROHARDNESS OF ZINC MONOCRYSTAL ELECTRODES: THE ELECTROCAPILLARY EFFECT
R. M. Latanision, H. Opperhauser, Jr., and A. R. C. Westwood Jan. 1972 19 p refs Presented at the Intern. Symp. on the Sci. of Hardness Testing and Its Res. Appl., 1971 Mater. Eng. Congr. (ASM), Detroit
(Contract N00014-70-C-0255; NR Proj. 036-087)
(AD-736697; RIAS-TR-72-01c; TR-4) Avail: NTIS CSCL 20/12

The microhardness of zinc monocrystal electrodes immersed in an aqueous electrolyte is shown to be sensitive to the applied potential provided that pyramidal slip about the hardness impression produces surface steps. Unlike some crystalline nonmetals and glasses in which environment-induced changes in the space charge layer are considered to be responsible for Rebinder effects, the above behavior in metals cannot be so ascribed. Indeed, it is suggested that variation in the energy required to form a surface slip step with electrode potential accounts satisfactorily for the present observations.
Author (GRA)

N72-23759# Brown Univ., Providence, R.I.
MATERIALS SCIENCE PROGRAM Annual Technical Report, 1 Jul. 1970 - 30 Jun. 1971
Dec. 1971 128 p refs
(Contract DAHC15-67-C-0217)
(AD-736724; ATR-10) Avail: NTIS CSCL 14/2

Contents: Low temperature properties of materials--metals (normal and superconducting), semiconductors, insulators, helium; Properties of materials at higher temperatures--metals, semiconductors, insulators, liquid metals; Properties of surfaces and films; Inorganic chemical compounds--structure and properties; Molecular structure and intermolecular forces; Defects and dislocations; Physical metallurgy--powder metallurgy, deformation studies; Magnetic materials and devices; Non-crystalline solids--structure and properties; Mechanical behavior of materials; Ultrasonics and acoustics; Mathematical - theoretical; Non-linear optics. GRA

N72-23760# Pennsylvania State Univ., University Park. Materials Research Lab.
MATERIALS PREPARATION AND CHARACTERIZATION RESEARCH Technical Summary Report, 1 Jul. - 31 Dec. 1971
Susan J. Countess, W. B. White, M. P. Ohoro, R. L. Mohler, and D. Tiche 31 Dec. 1971 33 p refs
(Contract DA-49-083-OSA-3140; ARPA Order 338)
(AD-736639) Avail: NTIS CSCL 20/12

The report summarizes annual research on the following subjects: New transducer and detector materials (organic pyroelectric detector materials, detector materials based on CdF2); Ferroelectric and ferroelastic materials for information storage and radiation detection (Bismuth titanates); Coatings, manipulation and characterization of real surfaces. GRA

N72-23761# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
UTILIZATION OF RARE EARTH IONS IN SINGLE CRYSTALS IN INFRARED QUANTUM COUNTER AMPLIFIER DEVICE APPLICATION Semiannual Report, 1 Jul. - 31 Dec. 1971
Francis K. Fong 31 Dec. 1971 10 p refs
(Grant DAHC15-70-G8)
(AD-736761) Avail: NTIS CSCL 07/4

The report covers the theoretical schemes and experimental techniques developed, tested, and applied to the actual realization of laser-pumped infrared quantum counter (IRQC) operation. The experiments involve (1) the growth of a variety of single crystals which might serve as appropriate hosts for active IRQC rare earth ions; (2) the measurement of radiationless relaxation times, the knowledge of which is important in optimizing the quantum efficiencies of IRQC processes; (3) spectroscopic measurements for the determination of the energy level schemes of rare earth ions in crystals which are of interest as potential IRQC materials; (4) the optimization of the c.w. operation of rhodamine 6-G and fluorescein dye lasers which are used as the optical pumps in the upconversion processes; and (5) laser-pumped IRQC experiments. Author (GRA)

N72-23762# Naval Research Lab., Orlando, Fla. Underwater Sound Reference Div.
THERMAL SHOCK TEST OF CAPPED PIEZOELECTRIC CERAMIC TUBES Interim Report
I. D. Groves, Jr. 24 Jan. 1972 11 p refs
(SF 1112130214083)
(AD-736920; NRL-MR-2379) Avail: NTIS CSCL 17/1

Piezoelectric ceramic tubes with capped ends are widely used in the construction of underwater sound transducers, although the ceramic bond between end cap and ceramic tube may be subjected to high stress if the thermal coefficient of expansion for the end-cap material is not approximately the same as that for the ceramic. To investigate the effect of temperature change on this bond, twelve capped ceramic tubes were subjected to a series of temperature changes from -51C to -74C to determine their ability to withstand the resultant stress. The tubes or bonds failed only when the temperature change was rapid and the thermal coefficients of expansions for tubes and caps differed by a factor of about 6. Author (GRA)

N72-23763# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
THERMOLUMINESCENCE OF YTTRIUM OXIDE SINGLE CRYSTALS Interim Technical Report
Peter L. Land and Edward T. Rodine Nov. 1971 116 p refs
(AF Proj. 7021)
(AD-736771; ARL-71-0258) Avail: NTIS CSCL 20/12

The report describes the thermoluminescence (TL) of six single crystals of yttrium oxide which are either rare earth doped or nominally pure. The fluorescence, coloration, and absorption behavior are also included. The glow peaks that are observed are sometimes common to several crystals and to other yttria samples studied here or elsewhere. The temperature dependence of the TL is analysed to provide the energy and frequency factors appropriate to the major electronic traps. Author (GRA)

N72-23764# Hughes Research Labs., Malibu, Calif.
IMAGE CONVERSION PANEL TECHNIQUES USING DIRECT CARRIER INJECTION (DIODE DEVELOPMENT) Semiannual Report, 1 Apr. - 30 Sep. 1971
J. M. Baird Jan. 1972 60 p refs
(Contract DAAB07-71-C-0166; DA Proj. 1S6-62705-A-056)
(AD-737345; ECOM-0166-1) Avail: NTIS CSCL 20/12

Large p-i-n diode structures suitable for use in millimeter

wave image conversion panels have been developed. Typical dimensions are 0.25 cm in width by 0.28 cm in length by 0.11 cm in thickness between injecting contacts. Ion implanted arsenic and alloyed aluminum form the n and p junctions, respectively, on 18 kiloohm - cm silicon. Image conversion panels operating at 10 frames/sec and containing up to 1000 diode elements can be constructed using the present diodes.
Author (GRA)

N72-23765# Brandeis Univ., Waltham, Mass. Dept. of Physics.
EXPERIMENTAL STUDIES OF MAGNETIC PHASE TRANSITIONS Final Report
Peter Heller Jan. 1972 10 p refs
(Grant AF-AFOSR-1480-68; AF Proj. 9764)
(AD-736881; AFOSR-72-0241TR) Avail: NTIS CSCL 20/12

During the period February 1, 1968 to December 31, 1971, the Principal Investigator and his research group carried out a number of detailed experimental studies of the behavior of magnetic spin systems at temperatures close to the magnetic ordering critical point. The principal experimental techniques employed were Nuclear Magnetic Resonance and Neutron Scattering. The experiments of the former type were carried out at Brandeis University. Those of the latter type were carried out at the High Flux Beam Reactor at the Brookhaven National Laboratory. With reference to the NMR experiments, some additional work was also done at the National Magnet Laboratory at the Massachusetts Institute of Technology. Author (GRA)

N72-23766# Illinois Univ., Urbana. Coordinated Science Lab.
INVESTIGATION OF THE SCATTERING OF LOW ENERGY ELECTRONS FROM THE SURFACE OF SINGLE CRYSTAL ALUMINUM
James M. Burkstrand Jan. 1972 130 p refs
(Contract DAAB07-67-C-0199; Grant AF-AFOSR-2034-71)
(AD-737043; UILU-Eng-72-2203; R-544) Avail: NTIS CSCL 20/12

Elastic and inelastic low energy diffraction (ELEED, ILEED) observations have been made on a clean surface of Al(100). Measurements on the (10) and (11) elastic diffraction beams were made using normally incident electrons in the energy range 30 - E - 170 eV. Peaks in the energy loss distribution are seen near 5, 10, 15, 26, and 31 eV, the dominant peaks near 10 and 15 eV corresponding to surface and bulk plasmon excitations respectively. Two types of structure are observed in the inelastic angular profiles: one closely correlated with the structure in the elastic angular profiles, and the second being substructure corresponding to different ILEED conditions. Energy intensity profiles (as a function of incident energy) for the (10) and (11) elastic and inelastic diffraction beams have been measured. These profiles also show primary and secondary structure. Within the substructure of the angular and energy intensity profiles are the first experimental observations of sideband diffraction. A comparison of the experimental results and the theoretical predictions of Duke and Laramore and of Duke and Bagchi is made. Author (GRA)

N72-23767# Autonetics, Anaheim, Calif.
FUNDAMENTAL STUDIES OF SEMICONDUCTORS HETEROEPITAXY Semiannual Report, Jul. - Dec. 1971
Ralph P. Ruth Jan. 1972 104 p refs
(Contract DAAH01-70-C-1311; ARPA Order 1585)
(AD-736851; C71-86.3/501; SAR-3) Avail: NTIS CSCL 20/12

The objective of this program is to carry out a fundamental study of nucleation and film growth mechanisms in heteroepitaxial semiconductor thin films, and to apply the results to the preparation of improved films and thin-film devices on insulating substrates. Both theoretical and experimental investigations are involved, with emphasis on chemical vapor deposition (CVD) techniques applied to the Si-on-Al2O3 and GaAs-on-Al2O3 systems. Two theoretical approaches to modeling the heteroepitaxial interface are being investigated. Author (GRA)

N72-23768# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
WAVE AMPLIFICATION IN SEMICONDUCTOR SOLID-STATE PLASMA
H. C. Hsieh and K. H. Mak Dec. 1971 68 p refs
(PB-205820; ISU-ERI-AMES-71081) Avail: NTIS CSCL 20L

The study concerns the investigation of transverse electromagnetic waves amplification in bulk solid-state plasmas; in particular, n-type InSb at 77K is considered. The hydrodynamic model of the semiconductors is used and from this model, the dispersion equation was derived. By using the growing mode criteria, the condition for spatial growth was obtained. The threshold dc electric field vs static magnetic field curves shows the usual parabolic-shaped characteristic. The magnetic field strengths for minimum threshold dc electric field are directly proportional to electron density and inversely proportional to frequency. Amplification is possible for frequencies up to the M-band. Author (GRA)

N72-23769# Helsinki Univ. (Finland).
TIGHT BINDING CORE STATES OF TRIGONAL SELENIUM
Peter Krusius and Eero Suosara 1971 36 p refs
(PB-205949; APS-PH-80) Avail: NTIS HC $3.00; Acta Polytechnica Scandinavica Publishing Office, Box 5073, Stockholm: Sw. kr. 10.00 CSCL 20L

Core states for crystal atoms of trigonal selenium are constructed by a central field approximation of the crystal potential, which is determined by a set of atomic eigenstates in the tight binding approximation. The influence of the central field approximation on the core states is estimated. The core states are used to construct Bloch wave functions and the choice of these functions with respect to the OPW method is discussed.
Author (GRA)

N72-23770# Gulf Radiation Technology, San Diego, Calif.
RESEARCH ON THE PHYSICS OF TRANSIENT RADIATION EFFECTS Final Report, 2 Feb. 1968 - 31 Oct. 1971
Joseph L. Azarewicz, Robert A. Berger, Rodolfo A. Cesena, Joseph F. Colwell, and Raymond Denson Feb. 1972 140 p refs
(Contract DAAG39-68-C-0060)
(AD-737312; Gulf-RT-A10870; HDL-060-3) Avail: NTIS CSCL 20/12

Contents: Theory of displacement damage in silicon; Experimental studies of permanent displacement damage; Displacement effects in gallium arsenide; Ionization studies in naphthalene; Free-carrier absorption in insulators: Evaluation of a proposed facility; Ionization studies in polystyrene; Model for short-term annealing of neutron damage in p-type silicon; Recombination lifetimes in gold-doped p-type silicon. GRA

N72-23771# Syracuse Univ., N.Y. Dept. of Physics.
ELECTRON SPIN RESONANCE STUDIES OF DEFECTS IN FLUORITES Final Report
Gunter K. Wessel Wright-Patterson AFB, Ohio AFML Nov. 1971 107 p refs
(Contract F33615-69-C-1161; AF Proj. 7371)
(AD-737314; AFML-TR-71-239) Avail: NTIS CSCL 20/12

The microwave spectra of calcium-fluoride doped with hydrogen as well as with gadolinium have been measured and the spin-Hamiltonian constants for the cubic and tetragonal spectra have been determined. Similar measurements have been made with calcium fluoride doubly doped with hydrogen and gadolinium. Again, the spin-Hamiltonian constants have been determined for the different spectra and temperature ranges. Using the spin-echo method, the phase memory times for individual hydrogen and gadolinium lines have been measured for the doubly doped CaF2 crystal. These relaxation time measurements have been related to existing theories. The microwave spectra of iron doped lead titanate have been measured at frequencies between 30 GHz and 75 GHz. The spin-Hamiltonian constants have been determined from the constants have been determined from the measurements and

have been related to the relative deformations by the internal electric field of this ferroelectric crystal. Author (GRA)

N72-23772# Rice Univ., Houston, Tex. Materials Science Lab.
RESEARCH ON RARE EARTH METALS AND COMPOUNDS AND DEVELOPMENT OF APPLICATIONS BASED ON THEIR MAGNETIC PROPERTIES Final Technical Report, 2 Nov. 1970 - 1 Nov. 1971
Paul L. Donoho, Franz R. Brotzen, Kamel Salama, and L. V. Benningfield 1 Dec. 1971 86 p refs
(Contract DAAH01-71-C-0259; ARPA Order 1685)
(AD-737311) Avail: NTIS CSCL 20/2

The report describes the technical acomplishments achieved during a one year research program on the magnetic and magnetoelastic properties of materials containing elements of the rare-earth series. A primary goal of this program was the development of highly efficient high-frequency ultrasonic transducers based on the extremely high magnetostriction found in most rare-earth materials. Work has been carried out on the propagation of elastic waves in holmium and terbium single crystals, and results have been obtained for the velocity and attenuation of such waves as functions of the temperature and the strength of an applied magnetic field. Single-crystal transducers of gadolinium and terbium have been constructed, and elastic-wave generation in these transducers has been observed, although only preliminary results have been attained. A new theory of magnetic and magnetoelastic effects in the rare earths has been developed, and it promises to shed new light on these phenomena. A facility for the growth of large single crystals of rare-earth materials has been constructed, making possible the study of a wide range of materials. Author (GRA)

N72-23773# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ZERO BIAS CONTACT RESISTANCES OF Au-GaaS SCHOTTKY BARRIERS, JANUARY 1969 - JUNE 1970
Malcolm M. McColl, Michael F. Millea, and Carver A. Mead (Calif. Inst. of Tech.) 1 Feb. 1972 32 p refs
(Contract F04701-71-C-0172)
(AD-737112; TR-0172(9230-20)-8; SAMSO-RE-72-17) Avail: NTIS CSCL 20/12

The contact resistances of gold-GaAs Schottky barriers have been measured at liquid nitrogen temperatures over the range of electron concentrations from 3.2 X 10 to the 18th power to 2.4 X 10 to the 19th power/cc. The theoretical treatment is based on that of Padovani and Stratton but is modified to include Franz's two-band model for the imaginary wave vector of the tunneling electrons and Conley and Mahan's correction to the space-charge potential in degenerate semiconductors. The results correlate well with the theory in the 3.2 X 10 to the 18th power to 5.6 X 10 to the 18th power/cc range of concentrations. The theory must be extended to include the effects of fluctuating depletion width (a suggestion originally made by Bethe) to adequately explain the low contact resistances observed with the heaviest doped GaAs. This material is a degenerate and heavily compensated tin alloy regrowth commonly used as an ohmic contact. Author (GRA)

N72-23774# State Univ. of New York, Stony Brook. Dept. of Materials Science.
LOW ENERGY ELECTRON DIFFRACTION OF SURFACES PERTAINING TO AEROSPACE NEEDS Final Scientific Report, 1 Jun. 1969 - 30 Nov. 1971
Franco P. Jona Jan. 1972 11 p
(Grant AF-AFOSR-1707-69; AF Proj. 9761)
(AD-737130; AFOSR-72-0240TR) Avail: NTIS CSCL 20/12

The report describes the accomplishments of the research effort supported by the above grant. The effort was directed toward detailed understanding of the scattering of low-energy electrons by solid surfaces, thus paving the way toward the solution of the surface-structural problem. Lists of oral presentations and of publications in scientific journals are provided. Author (GRA)

N72-23775# Westinghouse Research Labs., Pittsburgh, Pa.
MAGNETIC INTERACTIONS IN SEMICONDUCTORS Final Report
M. P. Mathur, D. W. Deis, C. K. Jones, and W. J. Carr, Jr. 2 Feb. 1972 14 p refs
(Contract F44620-69-C-0045; AF Proj. 9763)
(AD-737128; AFOSR-72-0174TR) Avail: NTIS CSCL 20/12

Magnetic ordering and superconductivity have been investigated in Mn and Eu doped SnTe. The study shows that Mn(--) spins couple ferromagnetically and e (--) spins antiferromagnetically. Heat capacity results showed anomalies attributable to Mn(--) coupling. The effect of magnetic impurity (x) on the superconducting transition temperature (T) was studied. This study shows a non-linear dependence of T on x. An anomalous effect of particle size on T in SnTe has been observed. Author (GRA)

N72-23776# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
THEORY FOR SUPERCONDUCTIVITY IN D-BAND METALS
K. H. Bennemann and J. W. Garland (Ill. Univ., Chicago) 29 Nov. 1971 37 p refs
(Contract N00014-67-A-0398-0004; NR Proj. 017-473)
(AD-737463) Avail: NTIS CSCL 20/12

Superconductivity in transition metals, in transition metal alloys, in A-15 compounds and in U6X compounds is studied within the framework of the B.C.S. theory. The electron-phonon coupling constant lambda is expressed in terms of measurable normal-state quantities and an atomic parameter. Then, using the McMillan formula for the superconducting transition temperature Tc, the variation of Tc in the three transition metal series is discussed. Calculated values for Tc are given for several transition metal alloys, U6X compounds and for Sc, Y, Lu, and La. Also, it is shown that in A-15 compounds Cooper pair fluctuations may occur even at temperatures several degrees Kelvin above Tc. Author (GRA)

N72-23777# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
TEMPERATURE DEPENDENCE OF LOCAL MAGNETIC MOMENTS IN PARAMAGNETIC METALS: HUBBARD'S ALLOY ANALOGY
29 Nov. 1971 33 p refs
(Contract N00014-67-A-0398-0004; NR Proj. 017-473)
(AD-737462) Avail: NTIS CSCL 20/12

The temperature T dependence of the local magnetic moments and the static uniform spin susceptibility chi (T) in paramagnetic metals is studied using the Hubbard Hamiltonian for non-degenerate bands. Hubbard's alloy analogy, which correctly describes both strongly interacting and weakly interacting systems of electrons, is applied to determine the average local moment magnitude. It is found that the magnetic moment magnitude decreases gradually with temperature and does not undergo a phase transition to a zero value. This is in contrast to the results of previous theories which predict a sharp phase transition associated with a disappearance at high temperatures of the moments. Author (GRA)

N72-23778# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
SPIN SUSCEPTIBILITY OF DISORDERED BINARY ALLOYS
K. Levin, R. Bass, and K. H. Bennemann 29 Nov. 1971 13 p refs
(Contract N00014-67-A-0398-0004; NR Proj. 017-473)
(AD-737461) Avail: NTIS CSCL 20/12

A new theory based on the coherent potential approximation is presented for the spin susceptibility chi in disordered binary alloys having arbitrary concentration and scattering potential strengths. In the dilute alloy limit the susceptibility contains all formerly derived expressions for chi as well as new physically significant terms. In the weak scattering limit, an extension of the local exchange enhancement model is obtained which can be satisfactorily applied to nondilute Pd-Pt. Author (GRA)

N72-23779# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
LOCALIZED PERTURBATION HAMILTONIAN AND THE FRIEDEL SUM RULE
R. Bass, K. Levin, and K. H. Bennemann 29 Nov. 1971 8 p refs
(Contract N00014-67-A-0398-0004; NR Proj. 017-473)
(AD-737460; TR-3) Avail: NTIS CSCL 20/12

It is shown that the localized perturbation model Hamiltonian is consistent with the Friedel Sum Rule obtained using charge neutrality arguments. The authors conclude that the localized perturbation model appears to be applicable to real physical systems, which result contradicts the conclusions of a recent paper by Stern. Author (GRA)

N72-23780# California Univ., Los Angeles. Dept. of Physics.
SUPEREXCHANGE
R. Orbach and Nai Li Huang 1971 12 p
(Contract N00014-69-A-0200-403; Grant NSF GP-21290)
(AD-736878) Avail: NTIS CSCL 20/12

The theory of superexchange couplings in ionic solids is reviewed using a configuration-interaction approach. A discussion is given of the origin of the Kanamori-Goodenough (KG) rules taking into account lack of orthogonalization between atomic orbitals. It is shown that this effect can reverse the sign expected from the KG rules. Contact is made with the theory of Anderson, and his potential and kinetic exchange contributions are identified within the configuration interaction picture. The systematics of superexchange interactions are investigated for d3 ions in the chalcogenides, and recent experimental work is cited in support of predictions. Author (GRA)

N72-23781# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
THEORY FOR THE PRESSURE DEPENDENCE OF T SUB c FOR NARROW BAND SUPERCONDUCTORS
J. W. Garland and K. H. Bennemann 29 Nov. 1971 40 p refs
Prepared in cooperation with Ill. Univ., Chicago and Argonne Natl. Lab., Ill.
(Contract N00014-67-A-0398-0004; IVR Proj. 017-473)
(AD-737464) Avail: NTIS CSCL 20/12

A theory for the pressure dependence of T sub c in narrow-band superconductors is proposed. New physical mechanisms which in transition metals lead to an increase under pressure in the Hopfield parameter eta and in some cases even an increase in T sub c are discussed. It is shown how investigations of the pressure dependence of T sub c may give information on the importance of lattice instability and/or spin fluctuations on T sub c. Approximate calculated values of the partial derivative of (T sub c) with respect to p are presented for all of the superconducting transition-metal elements and for a few compounds. Author (GRA)

N72-23782# Mathematical Sciences Northwest, Inc., Seattle, Wash.
NUMERICAL SOLUTION OF THREE DIMENSIONAL ELASTICITY PROBLEMS FOR SOLID ROCKET GRAINS BASED ON INTEGRAL EQUATIONS. VOLUME 1: INTEGRAL EQUATION FORMULATIONS Final Report
Alexander L. Deak Feb. 1972 179 p refs
(Contract F04611-70-C-0080)
(AD-737123; MSNW-72-68-1; AFRPL-TR-71-140-Vol-1) Avail: NTIS CSCL 20/11

Presented is a description of two FORTRAN programs for the static analysis of simple connected finite three-dimensional elastic solids. These methods are based on a surface integral form of Navier's elasticity equations and result either in a set of singular integral equations with Cauchy kernels, or in a set of regular integral equations for the unknown boundary values. Thus, the three-dimensional problem is effectively reduced to a two-dimensional problem. Over any portion of the boundary surface, eight combinations of the prescribed displacement and stress vector components are possible. The complement of these combinations is then calculated by the programs. Provision is made to obtain boundary stresses, interior stresses, strains, and displacements at any point in the body. The extension to linear viscoelasticity is discussed. Author (GRA)

N72-23783# Michigan Univ., Ann Arbor. Dept. of Materials and Metallurgical Engineering.
REPORT OF THE MATERIALS RESEARCH COUNCIL, 1971
Edward E. Hucke Dec. 1971 79 p refs
(Contract DAHC15-71-C-0253; ARPA Order 0236)
(AD-737277; Rept-005020) Avail: NTIS CSCL 14/2

The report describes the activities and output of the Materials Research Council for the year ending December 13, 1971. Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N72-23784 Utah Univ., Salt Lake City.
SOME EXPERIMENTS ON THE EFFECT OF THERMAL RADIATION ON COMPOSITE ROCKET PROPELLANTS Ph.D. Thesis
Carl Max Mihlfeith 1971 255 p
Avail: Univ. Microfilms Order No. 71-22140

A direct measurement was made of the dynamic response of burning solid-propellant strands to an externally imposed radiant heat flux. Burning rate changes were determined for both steady and periodic energy fluxes at atmospheric pressure. The strands were mounted at the secondary focus of an elliptical mirror system, and flux levels to 15 calories per second per square centimeter were obtained by use of a 5 kw xenon-mercury lamp. Steady-state burning rates were obtained by a photographic technique, and the periodic variations in mass evolution rates were detected by measurement of the recoil force on the strands. A quartz-crystal microphone was used as a microforce transducer. Dissert. Abstr.

N72-23785*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MSC CRYOGENICS SYMPOSIUM PAPERS
May 1971 514 p refs Symp. held at Houston, Texas, 20-21 May 1971
(NASA-TM-X-67794; MSC-04312) Avail: NTIS HC $27.75 CSCL 21I

The proceedings of a symposium to discuss the design, development, analysis, and testing of cryogenic oxygen storage and supply systems are presented. Subjects discussed are: (1) cryogenic oxygen tank design, (2) thermophysical property data and safety information, (3) heat transfer and thermal stratification in Apollo 14 cryogenic oxygen tanks, (4) cryogenic analysis program for mission planning and analysis, (5) testing and control of materials used in high pressure oxygen cryogenic systems, and Apollo 14 flight support and system performance. For individual titles, see N72-23786 through N72-23802.

N72-23786*# North American Rockwell Corp., Downey, Calif. Space Div.
REDESIGN OF THE APOLLO CRYOGENIC STORAGE SYSTEM
C. P. Bouman *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 1-13 (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 21I

An assessment of the Apollo 13 mission resulted in establishing new and revised requirements for the design of the oxygen tanks and the associated spacecraft system. Areas

discussed include new system requirements, system changes to Apollo 14, revised operational requirements, instrumentation, operational redlines, component isolation modes, and return enhancement capabilities. In order to show the relationship of the cryogenic system to the spacecraft, a short description of the system is presented. Author

N72-23787*# Beech Aircraft Corp., Boulder, Colo.
MODIFIED APOLLO CRYOGENIC OXYGEN TANK DESIGN
Kermit VanLeuven *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 14-30 (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 21I

Assessment of the Apollo 13 mission indicated that some design changes to be incorporated into Apollo cryogenic oxygen storage tanks. These changes broadly fit into three categories. They were: (1) deletion of the fluid equilibration motors and redesign of heater assembly, (2) material changes for internal tank wiring and density sensor, and (3) the addition of a heater assembly temperature sensor. Development of a cryogenic oxygen tank incorporating these changes is presented. Author

N72-23788*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
THERMOPHYSICAL PROPERTY DATA AND SAFETY INFORMATION c23
R. H. Kropschot *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 31-44 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

Precision measurements of the properties of oxygen over a wide range of temperature and pressure are complete. The primary remaining effort, which is in progress, is the representation of these data in the most usable format such as tables, equations, diagrams, and computer programs. In addition, safety data are essential to proper design, operation, and failure analysis. All of the available information on oxygen safety is being reviewed, evaluated and indexed for quick retrieval through the NASA Aerospace Safety Research and Data Institute program. The availability of data, where the major gaps in data occur, and retrieval of bibliographic information are discussed. Author

N72-23789*# Boeing Co., Seattle, Wash.
PRESSURIZED EXPULSION OF NONISOTHERMAL SINGLE-PHASE CRYOGEN
Clifford K. Forester *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 45-102 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 21I

The performance of single-phase storage and expulsion systems as affected by temperature variations within the stored cryogen which are generated during heat transfer is discussed. Peculiar operating responses are indicated by spontaneous changes in fluid pressure which accompany g level changes, increased heater surface temperature, and durations of pressure cycles which differ considerably from that which is computed for an isothermal cryogen. The nonisothermal characteristics are predicted with a numerical model which includes the simultaneous solution of the time dependent conservation equations of mass, energy, and momentum in two space dimensions of Cartesian coordinates for boundary conditions which approximate those of the flight cryogenic system. The methodology of the numerical method and some comparisons between the predictions and the Apollo 12 flight data are included. Author

N72-23790*# Boeing Co., Houston, Tex. Space Div.
CORRELATION OF APOLLO OXYGEN TANK THERMODYNAMIC PERFORMANCE PREDICTIONS c33
H. W. Patterson *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 103-129 (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20M

Parameters necessary to analyze the stratified performance of the Apollo oxygen tanks include g levels, tank elasticity, flow rates and pressurized volumes. Methods for estimating g levels and flow rates from flight plans prior to flight, and from guidance and system data for use in the post flight analysis are described. Equilibrium thermodynamic equations are developed for the effects of tank elasticity and pressurized volumes on the tank pressure response and their relative magnitudes are discussed. Correlations of tank pressures and heater temperatures from flight data with the results of a stratification model are shown. Heater temperatures were also estimated with empirical heat transfer agreement with flight data when fluid properties were averaged rather than evaluated at the mean film temperature. Author

N72-23791*# TRW Systems Group, Houston, Tex.
A NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR SUPERCRITICAL FLUID THERMODYNAMIC ANALYSIS c23
P. J. Heinmiller *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 130-181 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

An explicit numerical solution of the compressible Navier-Stokes equations is applied to the thermodynamic analysis of supercritical oxygen in the Apollo cryogenic storage system. The wave character is retained in the conservation equations which are written in the basic fluid variables for a two-dimensional Cartesian coordinate system. Control-volume cells are employed to simplify imposition of boundary conditions and to ensure strict observance of local and global conservation principles. Non-linear real-gas thermodynamic properties responsible for the pressure collapse phenomonon in supercritical fluids are represented by tabular and empirical functions relating pressure and temperature to density and internal energy. Wall boundary conditions are adjusted at one cell face to emit a prescribed mass flowrate. Scaling principles are invoked to achieve acceptable computer execution times for very low Mach number convection problems. Detailed simulations of thermal stratification and fluid mixing occurring under low acceleration in the Apollo 12 supercritical oxygen tank are presented which model the pressure decay associated with de-stratification induced by an ordinary vehicle maneuver and heater cycle operation. Author

N72-23792*# Bellcomm, Inc., Washington, D.C.
HEAT TRANSFER AND THERMAL STRATIFICATION IN THE APOLLO 14 CRYOGENIC OXYGEN TANKS c23
S. S. Fineblum, A. S. Haron, and J. A. Saxton *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 182-204 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

Two significant facets of Apollo oxygen tank operation are the occurrence of thermal stratification at high fluid densities and the tendency toward high heater temperatures at low fluid densities. Some insight into the nature of these phenomena can be gained, respectively, by consideration of a two fluid stratification model and a conductive heat transfer model. The alternative of convective blowdown tank operation at low densities is briefly examined. Author

N72-23793*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MIXING EFFECTIVENESS IN THE APOLLO OXYGEN TANKS OF SPIN-UP AND ROTATION-REVERSAL MANEUVERS
Barrett Baldwin, E. Dale Martin, Walter A. Reinhardt, and Yvonne Sheaffer *In its* MSC Cryog. Symp. Papers May 1971 p 205-232 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 21I

Two-dimensional simulations of stratified flows in the Apollo oxygen tanks have been used to estimate the mixing effectiveness of spin-up and rotation-reversal maneuvers. Calculations have been made for square and circular cylindrical tank geometries.

Differences arising from heater position on the tank wall or near the center of the tank have been investigated. In the event of a prolonged period without normal maneuvers, the potential pressure decay (drop in pressure that would result from adiabatic mixing) can be suppressed by more than a factor of two through the use of spin-up and rotation-reversal maneuvers. Changes in rotation rate of order three revolutions per hour or greater are sufficient for this purpose. Author

N72-23794*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STRATIFICATION CALCULATIONS IN A HEATED CRYOGENIC OXYGEN STORAGE TANK AT ZERO GRAVITY c23
John T. Shuttles and G. Louis Smith *In its* MSC Cryog. Symp. Papers May 1971 p 233-273 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

A cylindrical one-dimensional model of the Apollo cyrogenic oxygen storage tank has been developed to study the effect of stratification in the tank. Zero gravity was assumed, and only the thermally induced motions were considered. The governing equations were derived from conservation laws and solved on a digital computer. Realistic thermodynamic and transport properties were used. Calculations were made for a wide range of conditions. The results show the fluid behavior to be dependent on the quantity in the tank or equivalently the bulk fluid temperature. For high quantities (low temperatures) the tank pressure rose rapidly with heat addition, the heater temperature remained low, and significant pressure drop potentials accrued. For low quantities the tank pressure rose more slowly with heat addition and the heater temperature became high. A high degree of stratification resulted for all conditions; however, the stratified region extended appreciably into the tank only for the lowest tank quantity. Author

N72-23795*# North American Rockwell Corp., Downey, Calif. Space Div.
PREDICTION OF THE EFFECTS OF THERMAL STRATIFICATION ON PRESSURE AND TEMPERATURE RESPONSE OF THE APOLLO SUPERCRITICAL OXYGEN TANK c23
I. M. Chen and R. E. Anderson *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 274-300 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

A semiempirical design-oriented model has been developed for the prediction of the effects of thermal stratification on tank pressure and heater temperature response for the Apollo supercritical oxygen tank. The heat transfer formulation describes laminar free convection at low-g and takes into account the radiation and conduction processes occurring in the tank. The nonequilibrium thermodynamic behavior of the system due to localized heating of the stored fluid is represented by the characteristics of a discrete number of fluid regions and thermal nodes. Solutions to the time dependent variable fluid property problem are obtained through the use of a reference temperature procedure. A criterion which establishes the reference temperature as a function of the fluid density ratio is derived. The analytical results are compared with the flight data. Author

N72-23796*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE CRYOGENICS ANALYSIS PROGRAM FOR APOLLO MISSION PLANNING AND ANALYSIS c23
Walter Scott and Jack Williams (Lockheed Electronics Co., Houston, Tex.) *In its* MSC Cryog. Symp. Papers May 1971 p 301-330 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

The cryogenics analysis program was developed as a simplified tool for use in premission planning operations for the Apollo command service module. Through a dynamic development effort, the program has been extended to include real time and postflight analysis capabilities with nominal and contingency planning features. The technical aspects of the program and a comparison of ground test and mission data with data generated by using the cryogenics analysis program are presented. The results of the program capability to predict flight requirements also are presented. Comparisons of data from the program with data from flight results, from a tank qualifications program, and from various system anomalies that have been encountered are discussed. Future plans and additional considerations for the program also are included. Among these plans are a three tank management scheme for hydrogen, venting profile generation for Skylab, and a capability for handling two gas atmospheres. The plan for two gas atmospheres will involve the addition of the capability to handle nitrogen as well as oxygen and hydrogen. Author

N72-23797*# TRW Systems Group, Houston, Tex.
APOLLO CRYOGENIC INTEGRATED SYSTEMS PROGRAM c23
R. K. M. Seto and J. E. Cunningham *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 331-406 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

The integrated systems program is capable of simulating both nominal and anomalous operation of the Apollo cryogenics storage system (CSS). Two versions of the program exist; one for the Apollo 14 configuration and the other for J Type Mission configurations. The program consists of two mathematical models which are dynamically coupled. A model of the CSS components and lines determines the oxygen and hydrogen flowrate from each storage tank given the tank pressures and temperatures, and the electrical power subsystem and environmental control subsystem flow demands. Temperatures and pressures throughout the components and lines are also determined. A model of the CSS tankage determines the pressure and temperatures in the tanks given the flowrate from each tank and the thermal environment. The model accounts for tank stretch and includes simplified oxygen tank heater and stratification routines. The program is currently operational on the Univac 1108 computer. Author

N72-23798*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ZERO-GRAVITY TRANSIENT THERMAL MIXING SIMULATION c33
Jack F. Lands, Jr. and Robert C. Ried, Jr. *In its* MSC Cryog. Symp. Papers May 1971 p 407-432 (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20M

The experimental program described is an outgrowth of independent investigations into alternate redesign concepts for the Apollo SM cryogenic oxygen storage system. The experiments were continued, after the redesign was established, to provide physical insight into transient thermal mixing in zero-gravity and to aid in the characterization of the system performance in flight. Zero-gravity heat transfer and fluid mixing were simulated experimentally through an analogy between unsteady heat conduction and species diffusion. To further support numerical analyses of the cryogenic oxygen storage system, the experimental investigation was extended to include a cubical tank geometry, representative of existing numerical models. In general, the transient flow patterns in the cubical tank are far more complex than those of the spherical tank and the extent of fluid mixing is significantly greater but less repeatable. Author

N72-23799*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A REVIEW OF CRYOGENIC TESTING PERFORMED BY THE THERMOCHEMICAL TEST BRANCH, MANNED SPACECRAFT CENTER IN SUPPORT OF APOLLO 13 AND 14 c23
Clarence E. Propp and John M. McGee *In its* MSC Cryog. Symp. Papers May 1971 p 433-454 ref (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

The Apollo 13 anomaly provided considerable impetus for a variety of types of cryogenic and ignition tests. The logic of the various test program designs, the test techniques, and their final impact upon the investigation findings are described. In addition, several test programs initiated to determine the thermal performance and general performance characteristics of the redesigned Apollo 14 cryogenic storage system are presented.
Author

N72-23800*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FLAMMABILITY TESTING CONDUCTED IN SUPPORT OF APOLLO 13 **c33**
L. J. Leger and R. W. Bricker *In its* MSC Cryog. Symp. Papers May 1971 p 455-474 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20M

In support of the Apollo 13 investigation of the oxygen tank failure, flame propagation rates were determined for Teflon insulation in cryogenic and ambient temperature oxygen for upward, downward, and zero g burns. The propagation rates depended heavily on configuration and varied from 4.8 to 10.9 cm/sec for upward one g burns to 0.48 cm/sec for zero g burns. In addition to the flame propagation rates, tests were conducted to determine if Teflon burning in cryogenic oxygen could ignite metals (promoted ignition) with which it came in contact. Tests conducted on various metal alloys used in the oxygen tank indicated that most of the alloys could be ignited by burning Teflon in certain configurations. After the propagation rates and promoted metal ignitions had been evaluated, a test was conducted on a quantity gauge and wire harness used in the oxygen tank to determine if flame propagation to the tank wall was possible. Propagation of the wire bundle after ignition resulted in a catastrophic failure of the test vessel in the area of the quantity gauge.
Author

N72-23801*# General Electric Co., Houston, Tex. Apollo and Ground Systems.
TESTING AND CONTROL OF MATERIALS USED IN HIGH PRESSURE OXYGEN CRYOGENIC SYSTEMS **c23**
R. P. Segrest *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 475-487 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20L

Brief discussions of the materials and configurations testing techniques and requirements for the Apollo spacecraft high pressure oxygen systems are presented.
Author

N72-23802*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 14 FLIGHT SUPPORT AND SYSTEM PERFORMANCE **c31**
Robert R. Rice *In its* MSC Cryog. Symp. Papers May 1971 p 488-509 (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 22B

The Apollo 13 incident and subsequent oxygen tank redesign for Apollo 14 placed unique requirements on the flight support activity. A major part of this activity was the integration of the various analytical efforts into a single team function. Additionally, the first flight of the redesigned system without an orbital test required an extensive analytical base. The support team philosophy, objectives, and organization are presented. Various analytical tools that were used during the flight are discussed. Investigations made during the postflight period are considered and their impact upon subsequent flights shown.
Author

N72-23803# Oak Ridge National Lab., Tenn.
FUELS AND MATERIALS DEVELOPMENT PROGRAM Quarterly Report, period ending 30 Sep. 1971
P. Patriarca Dec. 1971 249 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3550) Avail: NTIS

Research and development progress is reported on FBR oxide fuels, advanced fast breeder reactor fuels, FBR neutron absorber materials, FBR fuel cladding materials, compatibility of LMFBR boiler materials, joining and nondestructive testing of materials, mechanical properties of structural materials, UN fuels for space power, tungsten metallurgy, metallurgy of refractory alloys, and cladding materials for space isotopic heat sources.
NSA

N72-23804# British Aircraft Corp. (Operating) Ltd., Bristol (England).
A STUDY OF MATERIALS COMPATIBILITY WITH HYDRAZINE
W. Berry, I. M. Gibbon, and D. R. Saw Paris ESRO Mar. 1971 167 p refs Prepared for ESRO
(Contract ESTEC-828-69)
(ESRO-CR-34) Avail: NTIS HC $10.50

The compatibility of anhydrous hydrazone monopropellant, used in satellite position and attitude control systems, with several metals and nonmetals of European origin was investigated, based on gas generation characteristics and resistance to chemical attack. The results for the comparative compatibility of 14 metallic and 36 nonmetallic samples are given. For the metals, significant results are that titanium and aluminum alloys were found to be very compatible, the gas generation rates being too low to be accurately detected. For the stainless steel samples, attempts to reproduce the initial gas rates were unsuccessful. No evidence of chemical attack was detected on any of the metals. Butyl and ethylene propylene rubbers and PTFE have good resistance to hydrazine attack. Silicon filled butyl rubbers have a low gas rate compared to carbon filled EP rubber.
Author (ESRO)

N72-23805# Monsanto Research Corp., Dayton, Ohio.
ENVIRONMENTAL DEGRADATION OF FUELS, FLUIDS, AND RELATED MATERIALS Technical Report, 1 Feb. 1969 - 30 Nov. 1971
William G. Scribner Jan. 1972 103 p refs
(Contract F33615-69-C-1325; AF Proj. 3048)
(AD-736839; MRC-DA-310; AFAPL-TR-71-101) Avail: NTIS

Research on hydrocarbon fuel properties (principally JP-7), fuel additives, and organic and inorganic contaminants in fuels is described. Analytical methods developed are presented in detail, and include a specific ion electrode method for PWA-536 in JP-7, gas chromatographic methods to 'fingerprint' JP-7 and to detect volatile contaminants, a column chromatographic-infrared spectrophotometric method to isolate and identify polar contaminants in JP-7, and atomic absorption spectrophotometric methods for metal naphthenates in fuels at the parts per billion level. Measurements of JP-7 heat of combustion, electrical, and other physical properties are tabulated. Bench and field studies of the depletion of fuel system icing inhibitor from JP-7 are presented. Detailed studies of a polyurethane foam degradation problem and the evaluation of a small scale test to measure thermal stability are summarized.
Author (GRA)

N72-23806# Shell Development Co., Emeryville, Calif.
HYDROCARBON FUELS FOR ADVANCED SYSTEMS Annual Technical Report No. 2, 1 Sep. 1970 - 31 Aug. 1971
L. E. Faith, G. H. Ackerman, C. K. Heck, H. T. Henderson, A. W. Ritchie, and L. B. Ryland Wright-Patterson AFB, Ohio AFAPL Dec. 1971 270 p refs
(Contract F33615-70-C-1038; AF Proj. 3048)
(AD-737372; S-14120; AFAPL-TR-70-71-Pt-2) Avail: NTIS CSCL 21/2

The general objective was the development of new hydrocarbon fuels and new fuel systems which will meet the cooling and propulsion requirements of advanced air-breathing engines. The preparation of catalysts for both packed bed and catalyst lined reactors and the evaluation of catalyst activity and stability for the dehydrogenation of methylcyclohexane and decalin discussed. Several catalyst lined reactors were tested

under realistic heat transfer and reaction conditions. The Beta-Ray Deposit Rater was developed, tested, and used to rate coke deposits on tubes from thermal stability tests. The effects of various stability additives in different fuels were investigated. Viscosities of different hydrocarbons, including shelldyne H and shelldyne - H/hydrocarbon mixtures, were measured. The effects of exposure to elastomers on the properties of shelldyne - H fuel were analyzed. Ignition delay times and combustion rates were measured for decalin and its dehydrogenation products. A bibliography of current articles and patents of interest to this and related programs is included. Author (GRA)

N72-23807# Stanford Research Inst., Menlo Park, Calif.
SOLID PROPELLANT KINETICS. 2: THEORETICAL ANALYSIS OF THE HETEROGENEOUS OPPOSED FLOW DIFFUSION FLAME Interim Report
C. W. Ablow and H. Wise 15 Dec. 1971 18 p refs
(Contract N00014-70-C-0155)
(AD-736217; SRI-PYU-8378) Avail: NTIS CSCL 21/9

A theoretical analysis is presented of the heterogeneous opposed flow diffusion flame (HOFD). In such a system a gaseous reactant (G) impinges on a solid reaction (S) undergoing sublimation (or vaporization) and a diffusion flame is established at the stagnation point. With increasing mass flux of the gaseous reactant (mG) the mass flux of solid reactant (mS) grows until the total consumption rate of reactants reaches a limiting value due to limitations imposed by the kinetics of reaction. The analysis of the axi-symmetrical stagnation point flow with chemical reaction allows evaluation of the kinetics of chemical reaction at temperatures of interest to combustion processes. Author (GRA)

N72-23808# Stanford Research Inst., Menlo Park, Calif.
SOLID PROPELLANT KINETICS. 3: EXPERIMENTAL STUDY OF THE OPPOSED FLOW SOLID PROPELLANT DIFFUSION FLAME Interim Report
S. H. Inami and H. Wise 15 Dec. 1971 20 p refs
(Contract N00014-70-C-0155)
(AD-736255; SRI-PYU-8378-3) Avail: NTIS CSCL 21/9

The kinetics of high-temperature reactions associated with solid-propellant deflagration are studied quantitatively by means of the heterogeneous opposed flow diffusion flame. In these experiments a cylindrical gas jet containing the gaseous fuel impinges on the surface of a solid propellant composed of ammonium perchlorate (AP) and copper chromite (CC) catalyst. A diffusion flame is established in the stagnation region formed by the two opposed flows of reactants. With increasing mass flux of gaseous fuel, the mass flux of solid AP/CC grows until a limiting condition is reached governed by the kinetics of reaction. Further enhancement in fuel flow does not result in any increase in the mass consumption rate of solid oxidizer. Author (GRA)

N72-23819# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Elektrische Antriebe und Energieversorgung.
A MERCURY FEED SYSTEM FOR ELECTROSTATIC ION THRUSTERS
H. J. Arlt *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 157-183 refs In GERMAN; ENGLISH summary (See N72-23811 14-28)
Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N72-23809* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BIPROPELLANT INJECTOR Patent
Robert W. Riebling, inventor (to NASA) Issued 21 Mar. 1972 5 p Filed 25 Sep. 1967 Sponsored by NASA
(NASA-Case-XNP-09461; US-Patent-3,650,474;
US-Patent-Appl-SN-670829; US-Patent-Class-239-418;
US-Patent-Class-239-433; US-Patent-Class-239-543) Avail: US Patent Office CSCL 21H

A bipropellant injector is described, which consists of a pair of concave deflector blocks with their concave surfaces facing one another. The concave surfaces diverge downwardly with a fixed-space relationship between them at the base of the injector. A triangular shute is formed in each concave surface by a pair of diverging sidewalls. The two shutes are opposite one another. A circular orifice is located at the apex of each shute to provide an inlet for propellant, such as fuel or oxidizer to enter the injector. Propellant, forced through each orifice as a circular jet, is directed downwardly along the shute, spreading out against the concave shute surface. The propellant forms a sheet which is limited between the shute's sidewalls. It finally clears the shute's lower edge, and mixes with the propellant flowing from the opposite shute along the centerline of the space between the injector blocks.
Official Gazette of the U.S. Patent Office

N72-23810* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID PROPELLANT ROCKET MOTOR NOZZLE Patent
Richard L. Bailey, Warren L. Dowler, and John I. Shafer, inventors (to NASA) Issued 14 Mar. 1972 6 p Filed 13 May 1970 Sponsored by NASA
(NASA-Case-NPO-11458; US-Patent-3,648,461;
US-Patent-Appl-SN-36926; US-Patent-Class-60-271;
US-Patent-Class-60-266) Avail: US Patent Office CSCL 21H

A thin wall nozzle formed of carbon or graphite fibers or filaments, disposed in a carbon or graphite bonder, is described. The nozzle is affixed to the high strength case by an elongated transition section formed of a carbonaceous material reinforced with carbonaceous fibers. The nozzle expansion cone has an insulative nonablative covering to prevent undue radiation of heat, and the transition section has an insulative layer of ablative or nonablative material to control the heat path to the metal casing. Official Gazette of the U.S. Patent Office

N72-23811# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
PROCEEDINGS OF THE DGLR SYMPOSIUM ELECTRIC PROPULSION SYSTEMS, PART 1
G. F. Au and H. W. Loeb Oct. 1971 349 p refs Partly in ENGLISH and partly in GERMAN Symp. held at Brunswick, West Germany, 22-23 Jun. 1971
(DLR-Mitt-71-21-Pt-1) Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

Electric propulsion research activities encompass ion propulsion thrusters with gas discharge ion sources, contact sources, colloid engines, and quasi-stationary magneto-hydrodynamic accelerators. The increased importance of electrostatic thrusters is noted. Also included are studies on fuel supply, hollow cathodes, energy transfer, power conditioning and diagnostic procedures. For individual titles, see N72-23812 through N72-23826.

N72-23812# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Elektrische Antriebe und Energieversorgung.
TEN YEARS RESEARCH ON ELECTRIC PROPULSION AT THE DFVLR, BRUNSWICK
G. F. Au *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 9-53 refs In GERMAN (See N72-23811 14-28)
Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

Reviewed are research facilities and scientific projects. The facility contains a high frequency generator for inductive plasma generation, a duoplasmatron ion source, a contact ion source, an

electromagnetic plasma accelerator and an electrostatic ion propulsion thruster with its corresponding vacuum equipment. Research concentrated on electrostatic ion propulsion thrusters with gas discharge ionization sources. An expansion of the vacuum chamber made it possible to study ion propulsion clusters with emphasis on design and performance of the hollow cathode and optimization of the acceleration grid system for optimal ion beam current. Transl. by G.G.

N72-23813*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PROPULSION SYSTEM DESIGN FOR SOLAR ELECTRIC SPACECRAFT

D. J. Kerrisk and T. D. Masek *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 55-79 refs (See N72-23811 14-28)

(Contract NAS7-100)

(NASA-CR-126398) Avail: NTIS HC $3.25; ZLDI Munich: 73.30 DM CSCL 21I

The requirements and some of the trade-offs for targeted, solar-powered, electrically propelled interplanetary spacecraft are presented. A description of a breadboard thrust subsystem now being tested is given, and an attempt is made to give some insight into the areas of subsystem interfaces, operational modes, and control requirements, and how they are to be traded-off against mission cost and risk. Author

N72-23814*# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.

EXHAUST CHARACTERISTICS OF A QUASI-STEADY MPD ACCELERATOR

K. E. Clark, R. G. Jahn, and W. F. VonJaskowsky *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 81-100 refs (See N72-23811 14-28)

(Grant NGL-31-001-005)

(NASA-CR-126399) Avail: NTIS HC $3.00; ZLDI Munich: 73.30 DM CSCL 21C

Spectroscopic studies, velocity probe measurements, and impact pressure profiles of the exhaust flow of a quasi-steady MPD accelerator revealed the existence of velocities significantly greater than 10 to the fourth power m/sec in the plume. On the basis of these data, there appears to be valid reason for doubting that the characteristic velocity is a fundamental limit for MPD accelerators. Author

N72-23815# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

RESEARCH ON ION PROPULSION AT ONERA

Emile LeGrives *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 101-112 refs (See N72-23811 14-28)

Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

Electrostatic thrusters of the cesium ion contact type suitable for station keeping and attitude control of synchronous satellites and the development of physical measurements and testing procedures on microthrusters are reported. Discussed are: (1) techniques used for sintering tungsten powder and for shaping ionizers; (2) passive and active control procedures for testing ionizers; (3) neutral fraction measurements; (4) ion optics computation methods; and (5) development of a test rig for simulation of attitude control by means of electric thrusters. Author

N72-23816# Royal Aircraft Establishment, Farnborough (England). Space Dept.

THE RAE 10 cm HOLLOW CATHODE MERCURY THRUSTER

B. P. Day and R. Hastings *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 113-123 refs (See N72-23811 14-28)

Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

The performance of the RAE 10 cm electron bombardment mercury ion engine is discussed. Results are given which show how, at 80 percent utilization efficiency, the discharge losses are reduced from 540 eV/ion to 260 eV/ion by increasing the grid open area ratio from 50 percent to 75 percent. The effect of mass flow rate and magnetic field strength on performance is also shown. Thermal time constants and the effect of hollow cathode flow rate on discharge potential are given and their implications are discussed in connection with engine control. Author

N72-23817# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Elektrische Antriebe und Energieversorgung.

CONTROL AND POWER CONDITIONING OF THE ELECTROSTATIC ION THRUSTER ESKA 18-P

Siegried Baumgarth and Werner A. Kleinkauf *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 125-146 refs In GERMAN (See N72-23811 14-28)

Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

The principle of electrostatic ion propulsion engines is outlined and requirements for power conditioning are discussed. A functional analysis on power conditioning is given for a hexagonal arrangement of six thrusters using a pulse width modulated energy supply unit. Two example propulsion characteristics are used to develop control behavior of the thruster during fluctuation of solar energy supply. Transl. by G.G.

N72-23818# Giessen Univ. (West Germany). Physikalisches Inst.

OPTIMIZATION OF THE 20 cm DIAMETER ION THRUSTER RIT 20

W. U. Klein and S. Koschade *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 147-156 In GERMAN (See N72-23811 14-28)

Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

The development of a high frequency, low pressure ion propulsion system of 20 cm diameter is reported. The engine delivers a 450 mA ion current at 6 kV extraction voltage and 150 W radio frequency supply with an ion production energy of about 400 eV/ion. The overall electrical efficiency is about 81 percent. Transl. by G.G.

N72-23819# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Elektrische Antriebe und Energieversorgung.

A MERCURY FEED SYSTEM FOR ELECTROSTATIC ION THRUSTERS c27

H. J. Arlt *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 157-183 refs In GERMAN; ENGLISH summary (See N72-23811 14-28)

Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

The manufacture and operation of a mercury propellant feed system for electrostatic ion thrusters is described. The feed system is composed of a mercury vaporizer, an isolator and a propellant tank. All components are designed for operation in zero-gravity. For the vaporizer an experimentally obtained characteristic curve is given within the required range of the mercury mass flow rate of the ion thruster ESKA 18. For the isolator the dependence of the breakdown voltage from the mass flow rate is reported. Further it is shown, that the emptying of the tank by gas pressure is accomplished Author

N72-23820# Giessen Univ. (West Germany). Physikalisches Inst.

OPTIMIZATIONS OF THE MICROENGINE RIT 4

Friedrich Trojan *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 185-200 In GERMAN (See N72-23811 14-28)

Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

The optimal design for a 4 cm ion microthrust engine produces a thrust of about 1 mN, a power condition of about 50

W, a beam current of about 10 mA and a beam voltage of about 2...4 kV. A system of 3...6 thrusters can be used to correct trajectories and positions of 0.5...2t satellites. Such a correction maneuver requires a yearly power supply of about 150 m/2.
Transl. by G.G.

N72-23821# Laboratoire d'Electronique et de Physique Appliquees, Paris (France).
BASIC STUDIES ON THE MAIN ELEMENTS OF A CESIUM CONTACT ION THRUSTER
A. Pelissier, J. Paulin, C. Loty, and J. F. Bonnal *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 201-230 refs (See N72-23811 14-28)
Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

The studies of the main elements of this type of ion thruster, as that is to say the ionizer, the ion optics and the neutralizer, are presented. After a short exposition of contact ionization theory, the main aspects of the technology of the porous tungsten materials are shown and some experimental results are also given. Author

N72-23822# Laboratoire d'Automatique et de Ses Applications Spatiales, Toulouse (France).
SYNTHESIS OF THE STUDIES CARRIED OUT BY THE LABORATOIRE D'AUTOMATIQUE ET DE SES APPLICATIONS SPATIALES DU CNRS ON THE SATELLITE STABILIZATION BY IONIC THRUSTERS
J. Lagasse, A. Costes, and J. C. Laprie *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 231-275 refs (See N72-23811 14-28)
Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

Satellite stabilization by ion propulsion is considered. Evaluated are different ion thruster configurations for orbit corrections and attitude control, attitude control laws using electrostatic deflection of the ion beam in connection with special purpose digital systems, mathematical models of the microthruster, and design and realization of microthruster associated electronics. Author

N72-23823# European Space Research and Technology Center, Noordwijk (Netherlands).
ESRO'S ACTIVITY IN ELECTRIC PROPULSION
J. Bracher *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 277-282 (See N72-23811 14-28)
Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

Auxilary propulsion by microthrusters for satellite attitude stabilization and station keeping with a thrust level lower than 10 to the minus two power is considered. Colloid thruster and field emission thruster concepts based on the electrostatic spraying principle are being evaluated. G.G.

N72-23824# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Plasmadynamik.
CONTINUATION OF RESEARCH WORK ON MPD ACCELERATORS
G. Kruelle *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 283-298 refs In GERMAN (See N72-23811 14-28)
Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

A review of research on electromagnetic propulsion is followed by a description and performance data for a plasma engine with superimposed divergent magnetic field. Included are mathematical calculations for determining current distribution in magnetohydrodynamic beams. Transl. by G.G.

N72-23825# Rome Univ. (Italy). Istituto di Macchine e Tecnologie Meccaniche.
ENERGY TRANSFER TO AN MPD QUASI-STEADY ACCELERATOR WITH ELECTROLYTIC CAPACITORS BANK
A. Fanchiotti and G. Simoni *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 299-330 refs (See N72-23811 14-28)
Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

It is shown that a low voltage configuration for an MPD quasi-steady state accelerator can be obtained by using electrolytic capacitors with very large capacities (5000 microfarad) and a very low voltage bank (200 V). Numerical analysis by Runge-Kutta integration of the transmission line equation for different values of the electrical parameters show that the most important parameter for the design of the line is the inductance of the single cell. Experimental and theoretical results show good agreement. Author

N72-23826# Royal Aircraft Establishment, Farnborough (England). Space Dept.
MEASUREMENTS OF THE THRUST AND EXHAUST CHARACTERISTICS OF A PULSED RAIL THRUSTER USING MERCURY PROPELLANT
B. C. Barber and D. G. Fearn *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 1 Oct. 1971 p 331-349 refs (See N72-23811 14-28)
Avail: NTIS HC $19.50; ZLDI Munich: 73.30 DM

Measurements are reported of the thrust and exhaust characteristics of a pulsed plasma rail thruster energized by a 1.0 or 1.3 microfarad capacitor charged up to 4.5 kV. This device, intended for satellite attitude control, uses mercury propellant injected by an auxiliary discharge between a trigger pin and a small mercury pool. Measurements using a beam-type thrust balance indicate that the thrust at 20 pulses/second rises from 5 dynes at 2 kV to 90 dynes at 4.5 kV. Plasma velocities derived from Langmuir probe data are broadly in agreement with those deduced from image converter photographs of the acceleration process. Author

N72-23827# Deutsche Gesellschaft fuer Luft- und Raumfahrt, Cologne (West Germany).
PROCEEDINGS OF THE DGLR SYMPOSIUM ELECTRIC PROPULSION SYSTEMS, PART 2
Oct. 1971 143 p refs Partly In GERMAN; Partly in ENGLISH; ENGLISH summary Conf. held at Brunswick, 22-23 Jun. 1971 (DRL-Mitt-71-22-Pt-2) Avail: NTIS HC $9.25; ZLDI Munich: 30.00 DM

Theoretical and experimental studies on ion thrusters with gas discharge sources consider ion production rates, hollow cathodes, fuel supply, energy expenditure, optimization and plasma diagnostics. For individual titles, see N72-23828 through N72-23833.

N72-23828# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Energiewandlung und Elektrische Antriebe.
PLASMA SOURCES FOR HALL ION THRUSTERS
E. Zeyfang *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, Part 2 Oct. 1971 p-22 refs In GERMAN; ENGLISH summary (See N72-23827 14-28)
Avail: NTIS HC $9.25; ZLDI Munich: 30.00 DM

Studies on plasma sources for Hall ion thrusters have been carried out to optimize the rate of ion generation. The plasma sources, type 3, are adapted to the geometry of the Hall ion thrusters. The working gas is ionized by a discharge which takes place between an annular anode and a heated annular slit hollow cathode. On the plasma source 3.2 for mercury, the influence of geometric parameters, mass flow rate, cathode temperature and discharge current on the ion generation has been investigated. Ion currents between 2 and 3 A corresponding to an ionization rate of 60-100 percent at effective ionization energies of about 200 eV/ion have been measured. Author

N72-23829# Giessen Univ. (West Germany). Physikalisches Inst.
PLASMA DIAGNOSTICS AND ENERGY BALANCE

INVESTIGATIONS ON THE RADIO FREQUENCY ION THRUSTER RIT 10

M. Schaefer *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, Part 2 Oct. 1971 p 23-38 refs In GERMAN (See N72-23827 14-28)

Avail: NTIS HC $9.25; ZLDI Munich: 30.00 DM

Measured distribution of electron temperature and plasma density as function of the discharge parameters pressure, radio frequency, magnetic field cross section and high frequency output, show that the extractable current increases in proportion to the absorbed high frequency output. A valid energy balance equation for a high frequency low pressure plasma is developed that is applicable to all gas types and container radii; optimal container proportions and theoretical generating energies for an ion calculated with this equation show good agreement with experimental results. Transl. by G.G.

N72-23830# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Elektrische Antriebe und Energieversorgung.

DIRECT THRUST MEASUREMENTS ON THE ION THRUSTER ESKA 18-P

H. J. Junge *In* DGLR Proc. of the DGLR Symp. Elect. Propulsion Systems, Part 2 Oct. 1971 p 39-60 refs In GERMAN (See N72-23827 14-28)

Avail: NTIS HC $9.25; ZLDI Munich: 30.00 DM

Thrust measurements on the electrostatic ion thruster showed that: (1) the effective thrust was smaller than predicted by electric data calculations; (2) low thrusts exhibited larger discrepancies between measured and predicted values than higher thrusts; (3) thrust decreasing effects of multiple charged ions were not established; (4) discrepancy between measured and calculated thrusts depended on used high frequencies because thrust deviation diminished with increasingly smaller potentials; and (5) thrust discrepancy corresponded generally with the effect of current divergence, but not sufficiently to explain the measured deviation. Transl. by G.G.

N72-23831# Royal Aircraft Establishment, Farnborough (England). Space Dept.

THE DEVELOPMENT OF HOLLOW CATHODES, VAPORIZERS AND ISOLATERS FOR USE IN MERCURY ION THRUSTERS

D. G. Fearn, C. M. Philip, and J. W. Pye *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, Part 2 Oct. 1971 p 61-84 refs (See N72-23827 14-28)

Avail: NTIS HC $9.25; ZLDI Munich: 30.00 DM

The operating and starting characteristics of the hollow cathodes used in the RAE 10 cm electron bombardment thruster are described, together with an improved electron emission theory. This theory, which involves both field-enhanced thermionic emission and sevondary emission by impact of metastable atoms, can account for the large currents drawn from the cathode, and experiments aimed at substantiating it are described. The vaporizers used in this work are also described. Reference is made to a gas flow calibration technique employed in their design and construction, and the relevant theory is given. The development of an isolator using an internal porous insulator is described; a suitable choice of parameters allows these devices to withstand any desired thruster potential throughout the complete operating pressure range. Author

N72-23832# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Elektrische Antriebe und Energieversorgung.

HOLLOW-CATHODE INVESTIGATIONS

H. Bessling *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, part 2 Oct. 1971 p 85-118 refs In GERMAN (See N72-23827 14-28)

Avail: NTIS HC $9.25; ZLDI Munich: 30.00 DM

A hollow cathode with an opening of about 0.28 mm diameter was evaluated as main cathode and neutralizer in an experimental electrostatic ion thruster system. Discharge characteristics at variable operational parameters were utilized to calculate the energy contribution for producing one electron depending on mass distribution, discharge current, cathode temperature, etc. The obtained diagrams were used to optimize the overall neutralization system consisting of cathode, fuel reservoir, and energy supply. An analytical expression was formulated for estimating energy expenditures per electron in relation to the various production data. Transl. by G.G.

N72-23833# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Elektrische Antriebe und Energieversorgung.

APPLICATION OF CLUSTERED ION THRUSTERS ESKA 28 FOR INTERPLANETARY MISSIONS

G. F. Au *In* DGLR Proc. of the DGLR Symp. Elec. Propulsion Systems, Part 2 Oct. 1971 p 119-143 refs In GERMAN (See N72-23827 14-28)

Avail: NTIS HC $9.25; ZLDI Munich: 30.00 DM

The increased importance of the Incore-Thermionic-Reactor (ITR) for electric thrusters is described and the advantages of electrostatic ion propulsion in interplanetary missions are outlined. Since the production of thrusts in the 1 to 2.5 N range requires relative large thruster diameters, a clustering technique for an optimal number of single electrostatic ion thrusters is projected. Calculations show that flight times during a Jupiter mission are much shorter for the same thrust when electrical propulsion is used than when chemical or nuclear systems are employed. Transl. by G.G.

N72-23834*# Aerojet Solid Propulsion Co., Sacramento, Calif. Advanced Technology.

DEVELOPMENT OF LOW COST FABRICATION TECHNIQUES FOR LARGE SOLID ROCKET NOZZLES Final Report

J. J. Warga Sep. 1971 277 p refs

(Contract NAS3-12064)

(NASA-CR-120900) Avail: NTIS HC $16.00 CSCL 21H

Property measurements and fabrication characteristics were determined and the performance in subscale (Minuteman Wing 2 second stage) motors was evaluated. It was demonstrated that the incorporation of low cost fabrication techniques in a full scale 260 in. nozzle could result in savings of $149,000 when compared with an identical design using tape-wrapped components throughout. Author

N72-23835*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPTICAL RADIATION FROM REGIONS DOWNSTREAM OF MERCURY BOMBARDMENT THRUSTERS

Nelson L. Milder and James S. Sovey 19 Apr. 1972 8 p refs Presented at 9th Elec. Propulsion Conf., Washington, D. C., 17-19 Apr. 1972; Sponsored by the Am. Inst. of Aeronaut. and Astronaut.

(NASA-TM-X-68030; E-6838) Avail: NTIS HC $3.00 CSCL 21C

A 0.5 meter focal length, plane grating monochromator was used to measure the radiance of spectral radiation emanating from regions downstream of a mercury bombardment thruster. The wavelength range investigated was 2800 A. This radiation was due primarily to the radiative decay of excited mercury atoms exhausted from the thruster. Radiance values ranged from 10 to the minus 11th power to 10 to the minus 9th power W/sq cm sr, varying with wavelength. For resonant radiation, the spectral radiance may exceed 10 to the minus 8th power W/sq cm sr. From such radiance measurements, it was concluded that the thruster background radiation should not interfere with the control functions of a star tracker viewing through the thruster exhaust, provided that the tracker is designed to operate with a sufficiently small field of view. Author

N72-23836*# General Dynamics Corp., San Diego, Calif.

STATIC PERFORMANCE OF A 13.97 CM (5.5 INCH) DIAMETER MODEL VTOL LIFT FAN

W. H. Lowe and R. W. Sanger Washington NASA May 1972 33 p
(Contract NAS3-15563)
(NASA-CR-2051; HST-TR-329-0-1) Avail: NTIS HC $3.00 CSCL 21E

A tip-turbine-driven fan of the type currently being used in wind tunnel tests of VTOL lift fan models was tested. Values of thrust, weight flow, exit total and static pressure, exit swirl angle, and turbine temperature drop were measured as a function of fan speed for several inlet and exit configurations. A standard fan performance map was also obtained. Author

N72-23837*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DYNAMICS OF A SUPERSONIC INLET-ENGINE COMBINATION SUBJECTED TO DISTURBANCES IN FUEL FLOW AND INLET OVERBOARD BYPASS AIRFLOW
Robert E. Wallhagen, Francis J. Paulovich, and Lucille C. Geyser Washington May 1972 46 p refs
(NASA-TM-X-2558; E-6115) Avail: NTIS HC $3.00 CSCL 21E

An axisymmetric mixed-compression supersonic inlet and a single-spool turbojet engine were dynamically tested at Mach 2.5. The propulsion system was subjected to sweep-frequency sinusoidal disturbances of either inlet overboard bypass airflow. The disturbances were at a logarithmic sweep rate of 1 decade per minute. Dynamic responses were taken of signals throughout the propulsion system. Selected signals were reduced relative to the prime propulsion system parameters. The experimental data are presented in Bode plots. Most of the plots are for a frequency range of 1.0 to 50 hertz. Author

N72-23838*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY EXPERIMENTS ON THE NOISE GENERATED BY TARGET-TYPE THRUST REVERSER MODELS
Orlando A. Gutierrez and James R. Stone Washington May 1972 61 p refs
(NASA-TM-X-2553; E-6707) Avail: NTIS HC $3.00 CSCL 21E

Experiments are reported on the noise generated by model V-gutter and semicylindrical target-type reversers with circular nozzles. Nozzles were 5.24 and 7.78 cm in diameter. Nozzle pressure ratio ranged from 1.25 to 1.72. The spacing between reversers and nozzle, as well as the reverser orientation, was also varied. More noise was generated with reversers than with the nozzle alone. The measured maximum overall sound pressure level varied with the sixth power of the nozzle exit velocity. Noise levels were more uniform in regard to directivity with reversers than with the nozzle alone. It is concluded that thrust reversers, can be a significant noise problem, especially for STOL aircraft using thrust reversers during approach. Author

N72-23839*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
UPPER-STAGE SPACE SHUTTLE PROPULSION BY MEANS OF SEPARATE SCRAMJET AND ROCKET ENGINES
Leo C. Franciscus and John L. Allen Washington May 1972 51 p refs
(NASA-TN-D-6762; E-6555) Avail: NTIS HC $3.00 CSCL 21H

A preliminary mission study of a reusable vehicle from staging to orbit indicates payload advantages for a dual-propulsion system consisting of separate scramjet and rocket engines. In the analysis the scramjet operated continuously and the initiation of rocket operation was varied. For a stage weight of 500,000 lb the payload was 10.4 percent of stage weight or 70 percent greater than that of a comparable all-rocket-powered stage. When compared with a reusable two-state rocket vehicle having 50,000 lb payload, the use of the dual propulsion system for the second stage resulted in significant decreases in lift-off weight and empty weight, indicating possible lower hardware costs. Author

N72-23840# Joint Publications Research Service, Washington, D.C.
INFLUENCE OF THE SURFACE STATE OF CASTINGS OF TURBINE BLADES ON THEIR OPERATING PROPERTIES
V. V. Gayduk and G. V. Kulygin 4 May 1972 4 p Transl. into ENGLISH from Liteinoe Proizvod. (Moscow), no. 7, 1971 p 3
(JPRS-55881) Avail: NTIS HC $3.00

The application of pattern casting to heat-resistant alloys for use in turbine blades is considered. Natural castings of ZhS6K and ZhS3LS alloys smelted and cast in vacuum were investigated. Stress analyses were conducted on the samples and heat resistance was analyzed, as well as scale resistance and microhardness. Comparison tests for fatigue revealed a slight advantage of marginless samples over the untreated cast surface, compared to ground unpolished surfaces. Vibration polishing is also discussed. K.P.D.

N72-23841*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SATELLITE AUXILIARY-PROPULSION SELECTION TECHNIQUES. ADDENDUM: A SURVEY OF AUXILIARY ELECTRIC PROPULSION SYSTEMS
Lee B. Holcomb 15 Jul. 1971 53 p refs
(Contract NAS7-100)
(NASA-CR-126544; JPL-TR-32-1505-Add) Avail: NTIS HC $4.75 CSCL 21C

A review of electric thrusters for satellite auxiliary propulsion was conducted at JPL during the past year. Comparisons of the various thrusters for attitude propulsion and east-west and north-south stationkeeping were made based upon performance, mass, power, and demonstrated life. Reliability and cost are also discussed. The method of electrical acceleration of propellant served to divide the thruster systems into two groups: electrostatic and electromagnetic. Ion and colloid thrusters fall within the electrostatically accelerated group while MPD and pulsed plasma thrusters comprise the electromagnetically accelerated group. The survey was confined to research in the United States with accent on flight and flight prototype systems. Author

N72-23842# Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.
DESIGN CRITERIA FOR HYDROGEN BURNING ENGINES Final Report, 1 Jun. 1970 - 30 Sep. 1971
Roger J. Schoeppel Oct. 1971 157 p refs
(Contract EPA-EHSH-70-103)
(PB-205815; APTD-0901) Avail: NTIS HC $4.75 CSCL 21B

Laboratory experiments have demonstrated hydrogen not only to be an excellent substitute for conventional hydrocarbon fuels in internal combustion engines but also to have the inherent qualities necessary for a permanent solution to the air pollution problem. This conclusion was reached after extensive tests were conducted with an aircooled single-cylinder gasoline engine converted to run on hydrogen. The engine's operational characteristics compared favorable with those of its gasoline counterpart. Furthermore, the NOX content of the exhaust was an order of magnitude lower than that expected from a gasoline engine. Trace amounts of unburned hydrocarbons and carbon oxides, also present, originated from the lubricating oil. It was concluded from these experiments that a multi-cylinder automotive engine converted to run on hydrogen should be able to meet the 1975/76 Federal Emission Standards. Author (GRA)

N72-23843# Rocketdyne, McGregor, Tex. Solid Rocket Div.
APPLICATION OF ELECTROSLAG MELTED STEEL TO ROCKET CASE FABRICATION Final Technical Report, 1 Feb. - 31 Dec. 1970
D. J. Butler, V. Levy, and J. H. Oxley Wright-Patterson AFB, Ohio AFML 30 Apr. 1971 74 p
(Contract F33615-70-C-1369; AF Proj. 783-9)
(AD-736869; R-4621-2; AFML-TR-71-33) Avail: NTIS CSCL 21/8

Seven 16-inch OD hollow billets of ESR D6a steel were

cast and machined to produce 13 preforms, approximately 12 inches long. Eleven of these preforms were shear spun into thin wall rocket motor sections. Chemical, mechanical, and nondestructive tests were conducted on the ESR billets, on shear spun cylinders, and on weldments made with specimens from the cylinders. Comparisons were made between D6a ESR steel and D6ac steel which is used for current production of Phoenix rocket motor cases. These comparisons included machinability, shear spinning behavior, weldability with an electron beam welder, and mechanical properties. Two Phoenix rocket motor cases were fabricated using the ESR shear spun cylinders, and hydroburst tests of these cases were conducted.

Author (GRA)

N72-23844# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MATERIALS, TECHNOLOGY AND ECONOMICS OF PRODUCTION

Z. M. Kurchik 9 Nov. 1971 17 p refs Transl. into ENGLISH from Energomashinostroenie (Moscow), no. 6, 1970 p 28-30

(AD-736912; FTD-MT-24-1416-71) Avail: NTIS CSCL 21/5

In order to increase the level of technology of the production of turbine blades, increase their quality, reduce labor consumption and save metals, the All Union Planning and Technological Institutute of Energomash has suggested that the production of turbine blades be centralized. A specialized turbine blade plant is being created in Leningrad. The plant will be a combine for the manufacture of blanks and mechanical working of turbine blades of all designs and dimensions of various types of steels and alloys. Author (GRA)

N72-23845# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.

AN ANALYSIS OF LOSSES AND SECONDARY FLOW IN TURBINE CASCADES

W. Hosny and W. Tabakoff Dec. 1971 81 p refs

(Contract DAHC04-69-C-0016; Grant DA-ARO(D)-31-124-g154; Proj. Themis)

(AD-736853; THEMIS-AE-71-23; AROD-T-4-41-E) Avail: NTIS CSCL 21/5

A general review of different cascade losses is presented with emphasis on the secondary flow. An analytical analysis utilizing the Squire and Winter secondary flow analysis along with the triangle model for end wall boundary layer proposed by Taylor is detailed in an attempt to show the behavior of streamlines near the end wall. Author (GRA)

N72-23846# California Univ., Santa Barbara. Dept. of Electrical Engineering.

AUTOMATED DESIGN OF SPACE BOOSTER CONTROL SYSTEMS Interim Report

Edwin B. Stear and Charles P. Lefkowitz (TRW Systems Group, Redondo Beach, Calif.) Feb. 1972 45 p refs Presented at Joint Conf. on Mathematical and Computer Aids to Design, Anaheim, Calif., 1969

(Contract F04701-68-C-0164; Grant AF-AFOSR-0699-67; AF Proj. 9749)

(AD-737132; AFOSR-72-0374TR) Avail: NTIS CSCL 21/8

The paper describes a new algorithm for the automated design of compensators for space booster control systems. Use of this algorithm results in the selection of a forward-loop compensation filter (or filters, if filter switching is used), and a compatible time-dependent gain schedule which will stabilize the booster for a complete ascent stage by producing a loop gain and phase vs frequency response which will satisfy a set of specified stability margins at critical flight times. The algorithm is based on minimizing a nonlinear penalty function which is a function of the violations of the specified stability margins. Gradient search techniques are used in the algorithm to carry out the minimization of the penalty function. Author (GRA)

N72-23847# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.

DESIGN OF MAXIMUM THRUST NOZZLES WITH NONEQUILIBRIUM, CHEMICALLY REACTING FLOW. VOLUME 1: THEORETICAL DEVELOPMENT AND RESULTS Final Technical Report, 1 Jan. 1969 - 31 Aug. 1971

Allan A. Taylor and Joe D. Hoffman Wright-Patterson AFB, Ohio AFAPL Dec. 1971 64 p refs

(Contract F33615-67-C-1068; AF Proj. 3012)

(AD-737378; AFAPL-TR-71-92-Vol-1) Avail: NTIS CSCL 21/5

An analysis is presented which permits the design of maximum thrust nozzles for nonequilibrium chemically reacting gas flows. The analysis is based upon the governing equations for a general, multi-component reacting gas. The effects of viscosity, multiple phases, body forces and mixing are neglected. All other states of the gas are assumed to be in equilibrium. Design of the nozzle contour is posed subject to a general isoperimetric constraint. The thrust to be maximized is written in terms of an integral of the pressure forces on the nozzle wall. The design constraints and governing equations are incorporated into the integral to be maximized by means of Lagrange multipliers. Author (GRA)

N72-23848# Purdue Univ., Lafayette, Ind. Jet Propulsion Lab.

DESIGN OF MAXIMUM THRUST NOZZLES WITH NONEQUILIBRIUM, CHEMICALLY REACTING FLOW. VOLUME 2: COMPUTER PROGRAM MANUAL Final Technical Report, 1 Jan. 1969 - 31 Aug. 1971

Allan A. Taylor and Joe D. Hoffman Wright-Patterson AFB, Ohio AFAPL Dec. 1971 89 p refs

(Contract F33615-67-C-1068; AF Proj. 3012)

(AD-737379; AFAPL-TR-71-92-Vol-2) Avail: NTIS CSCL 21/5

Volume I of this report contains the theoretical development for design of maximum thrust nozzles with nonequilibrium, chemically reacting flow. The results of selected parametric studies are also presented. This volume contains a discussion of the computer program that was developed to permit the design capability. The organization of the program is presented and general information is given. An abbreviated description of all the subroutines is given. The input data are discussed in some depth, to assist the potential designer. Finally, four sample cases are presented, one in detail to illustrate the various input options. Author (GRA)

N72-23849# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.

DESIGN OF MAXIMUM THRUST PLUG NOZZLES WITH VARIABLE INLET GEOMETRY. VOLUME 2: COMPUTER PROGRAM MANUAL Technical Report, 15 Sep. 1968 - 31 Sep. 1970

Gearold R. Johnson, H. Doyle Thompson, and Joe D. Hoffman Wright-Patterson AFB, Ohio AFAPL Dec. 1971 60 p ref

(Contract F33615-67-C-1068; AF Proj. 3012)

(AD-736466; AFAPL-TR-70-75-Vol-2) Avail: NTIS CSCL 09/2

The problem of designing two-dimensional or axisymmetric plug nozzles with variable inlet geometry which produce the maximum axial thrust when an engineering constraint is imposed on the plug contour, for example, fixed length, has been formulated and numerically solved. The formulation was written to consider a gas mixture whose composition is either fixed or in chemical equilibrium. The effects of the boundary layer thickness and the wall shear stress are included in the problem formulation. The optimization analysis and the results from selected parametric studies are presented in Volume I of this report. This volume, Volume II, contains a description of the computer program, a discussion of the input parameters, and the results of six sample cases. Author (GRA)

N72-23850# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.

THREE DIMENSIONAL NOZZLE DESIGN FOR MAXIMUM THRUST. VOLUME 2: COMPUTER PROGRAM MANUAL Technical Report, 1 Sep. 1966 - 1 Sep. 1971

Lynn E. Snyder and H. Doyle Thompson Wright-Patterson AFB, Ohio AFAPL Dec. 1971 57 p refs
(Contract F33615-67-C-1068)
(AD-736820; AFAPL-TR-70-79-Vol-2) Avail: NTIS CSCL 21/5

The problem of designing three-dimensional (nonaxisymmetric) supersonic nozzles which produce the maximum axial thrust for a prescribed upstream flow field, mass flow rate, exit lip shape and position, and ambient pressure has been formulated and numerically solved. The formulation was written to consider a three-dimensional, supersonic, isoenergetic, homentropic flow of a perfect gas. This volume contains a description of the computer program organization and overlay structure, a description of each main program and each subroutine, a description of the input parameters, and the input listing and selected output for a sample case to illustrate the use of the design programs.
Author (GRA)

N72-23011# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
MEETING PROPULSION NEEDS OF FUTURE HIGH PERFORMANCE V/STOL
A. Jackson *In* DGLR Rept. on the DGLR-Symp. on Design Probl. of V/STOL Propellers and Rotors Dec. 1971 p 85-133 (See N72-23008 14-02)
(DGLR-71-018) Avail: NTIS HC $17.50; ZLDI Munich: 64.90 DM

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation, and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N72-23851 Ohio State Univ., Columbus.
QUANTITATIVE INTERPRETATION OF THE INFRARED SPECTRA OF LATE-TYPE STARS Ph.D. Thesis
Stephan Donald Price 1970 150 p
Avail: Univ. Microfilms Order No. 71-18068

The effects on wide bandpass infrared photometry of cool stars caused by blanketing due to molecular absorptions in the stellar atmosphere are investigated. Absorption by H2O, CO, CN, C2, TiO, and VO is considered in the spectral region 0.7 to 6.3 microns for stellar temperatures of 1500 to 4000 K. Molecular absorption coefficients for TiO, VO, CN, and C2 are calculated. The results of the calculations of the absorption coefficients for the infrared transitions of CN and C2 are presented in detail. Calculated spectra are compared to published infrared spectra. For two supergiants the agreement is good only if the H2O abundance is assumed to be very low, thus giving quantitative support to the hypothesis that the early M supergiants have a lower oxygen-to-carbon ratio than the sun. Synthetic spectra are convolved with filters of the Johnson photometric system. The (I-L) index is found to be a good measure of the stellar continuum distribution in K and M stars, but it is strongly influenced by CN and C2 absorptions in carbon stars.
Dissert. Abstr.

N72-23852 California Univ., San Diego.
THE ASTROPHYSICAL APPLICATIONS OF VARIOUS HIGH ENERGY ELECTROMAGNETIC PHENOMENA Ph.D. Thesis
George Ray Blumenthal 1971 154 p
Avail: Univ. Microfilms Order No. 71-18671

The effects of various energy-loss mechanisms on the distribution of relativistic electrons in various astrophysical circumstances are considered. If the electron loses a small fraction of its energy in a single occurrence of a process, the electron distribution function satisfies a continuity, differential equation in energy space. For the more general case where the electron can lose energy in discrete amounts, the electron distribution function satisfies an integrodifferential equation. The energy loss of high-energy cosmic rays in pair-producing collisions with ambient photons is also considered. General and essentially exact formulas are derived for this process for high-energy cosmic ray nuclei traversing an isotropic radiation field of arbitrary energy spectrum. A calculation is also presented for the opacity of the universe to high-energy cosmic photons. Compton scattering and pair-production in collisions with the intergalactic medium are considered. Finally two processes through which cosmic ray nuclei produce high-energy photons are considered.
Dissert. Abstr.

N72-23853 Catholic Univ. of America, Washington, D.C.
GALACTIC X-RAY SOURCES Ph.D. Thesis
John Edward Mack, Jr. 1971 117 p
Avail: Univ. Microfilms Order No. 71-17864

A series of two experiments was performed to determine the intensities and positions of celestial X-ray sources. The experiments consisted of large area, collimated proportional counters carried to high altitudes by sounding rockets. One rocket was allowed to spin and precess freely; the other was oriented to scan the galactic plane at a constant rate by a control system. The launches took place at Natal, Brazil. The galactic latitude of these sources was determined better than before and it is argued that the X-ray objects must be farther away than has been thought. Evidence was found for an excess of diffuse X-ray emission in the galactic plane compared with the diffuse background seen out of the plane. From both its intensity and its statistical variance, it is shown that this emission is compatible with production by distant, unresolved sources in the galaxy. The X-ray luminosity of the galaxy was estimated to be 2 x 10 to the 39th power erg/sec. The number of X-ray sources in the galaxy was estimated to be about 150. Dissert. Abstr.

N72-23854 California Univ., San Diego.
A STUDY OF CORRELATION OF HARD SOLAR X-RAY AND RADIO EMISSION Ph.D. Thesis
David Leroy McKenzie 1971 130 p
Avail: Univ. Microfilms Order No. 71-21687

The third Orbiting Solar Observatory carried an instrument which measured X-rays from solar flares in the energy range 7.7 to 12.5 keV. Spectral and temporal properties were studied for more than 300 solar X-ray bursts having accompanying microwave emission such that radio and X-ray burst peaked within four minutes of one another. Two-point spectra taken during the decay of bursts were interpreted as arising from thermal free-free and free-bound emission. Start, peak, and end times of X-ray bursts were measured with respect to corresponding times of associated microwave bursts. A model was investigated, in which energy for heating of the soft X-ray source region is supplied by collisional energy transfer from nonthermal electrons. Correlation between type III radio burst and X-ray bursts was studied.
Dissert. Abstr.

N72-23855*# Texas A&M Univ., College Station. Dept. of Physics.
DEGREE AND PLANE OF POLARIZATION OF MULTIPLE SCATTERED LIGHT. 1: HOMOGENEOUS CLOUD LAYERS
George W. Kattawar and Gilbert N. Plass 1 Apr. 1972 45 p refs
(Grant NGR-44-001-117)
(NASA-CR-126529; Rept-3) Avail: NTIS HC $4.25 CSCL 04A

The degree of polarization and the direction of the plane of polarization are calculated by a Monte Carlo method for homogeneous layers. Two solar zenith angles and a range of optical thicknesses up to 10 are considered. The results are compared with calculations for single scattered photons. For a given pair of incident and scattered directions, there are only two possible values for the direction of the plane of polarization differing by 90 deg for single scattering from spherical aerosols. The choice between these two values depends only on the sign of the element M(-) in the first row and second column of the scattering matrix in the I, Q, U, V representation. In most cases

there is little change in the direction of the plane of polarization when multiple scattering is taken into account, so that this quantity can usually be predicted from a very simple trigonometric relationship to good accuracy. Measurements of the direction of the plane of polarization at appropriately chosen angles provides information about the size distribution of the scattering centers. Author

N72-23856*# California Univ., Riverside. Inst. of Geophysics and Planetary Physics.
ELECTRONICS IMPLEMENTATION OF THE SOLAR NEUTRON EXPERIMENT
Wayne A. Millard, George M. Simnett, and R. Stephen White Dec. 1970 80 p
(Grant NGR-05-008-022; Contract N00014-69-A-0200-5001)
(NASA-CR-126393) Avail: NTIS HC $6.00 CSCL 03B

The electronic equipment design and function are discussed for the solar neutron counter experiment. Circuit diagrams are included. Author

N72-23857# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE ELECTRON SPECTRA IN EARTH'S INNER RADIATION BELT ON THE KOSMOS-219
O. I. Savun and P. I. Shavrin [1972] 13 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 9, no. 6, 1971 p 90-895
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Measurements of electron spectra in 1968, and comparison with data obtained in 1962 to 1966, permitted analysis of the change in spectral shape in the earth's inner radiation belt. It was observed that the spectra could be divided into two components: soft ($E < 0.8$ MeV) and hard ($E > 0.8$ MeV). Integral and differential spectra are presented for electrons with $E = 0.13$ to 0.15 MeV at $L = 1.2$ to 1.8, as well as the spatial electron distribution in the inner belt. Author

N72-23858# National Physical Lab., New Delhi (India).
HF AND LF EFFECTS IN DELHI DURING NOVEMBER 1969 SOLAR PROTON EVENTS
A. P. Mitra, C. V. Subrahmanyam, and L. H. Sarma Oct. 1971 15 p refs Presented at COSPAR Symp. on Nov. 1969 Proton Flare Events, Boston, 16-18 Jun. 1971
(Contract E-2-68(N))
(RSD-69; PL-480-13) Avail: NTIS HC $3.00

A decrease in signal strength is described, which occurred in the 164 KHz transmission from Tashkent, USSR received in Delhi, India, coinciding with the solar proton event of November 1969. The effect began at 1200 UT, at the same time as the first increase in proton flux for energies greater than 60 Mev. The signal recovered to its normal value at 1600 UT, but beginning at 2000 UT there was a record decrease, with a minimum at 2200 UT coinciding with the large proton flux maximum. No effect was observed for the proton flare of 24 November 1969. An anomaly existed in the relative magnitudes of SCNA's on the two days. For 24 November, SCNA's were observed at 22.4 and 30 MHz; comparison of the effects at the two frequencies indicated a substantial lowering of the region to a level not usually reached. Author

N72-23859# Lockheed Missiles and Space Co., Palo Alto, Calif.
COMPOSITION OF FAST CHARGED PARTICLES IN THE INNER RADIATION BELT
E. V. Gorchakov and M. V. Ternovskaia [1972] 5 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 9, no. 4, 1971 p 622-624
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The results are presented for proton and electron measurements on the Cosmos 137 satellite. The characteristics of the Cerenkov detector used are discussed. It is concluded that the experimental value of the relaxation time of artificially injected electrons, estimated to be on the order of 6 to 8 months, agrees well with the relaxation time determined by Coulomb losses. Author

N72-23860# Lockheed Missiles and Space Co., Palo Alto, Calif.
IONIZING RADIATION AT 200-300km ALTITUDES
V. L. Maduev, B. M. Makhmudov, and S. N. Kuznetsov [1972] 5 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 11, no. 5, 1971 p 771-775
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

On the basis of data obtained from the Cosmos 228 satellite, differential energy spectra were determined for 60 to 450 kev electrons in the earth's inner and outer radiation belts. Influxes of particles trapped in the $L = 1.1$ to 5 range were also investigated. A map was constructed showing the location of particle influx and trapping at about 250 km altitude. Author

N72-23861# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
COSMIC RAY NM-64 NEUTRON MONITOR DATA, CHACALTAYA, BOLIVIA. 4: JANUARY - DECEMBER 1970
R. Anda (Univ. Mayor de San Andres), G. R. Mejia (Univ. Mayor de San Andres), and J. F. Steljes Sep. 1971 54 p refs In ENGLISH and SPANISH
(AECL-4055) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River: $1.50

Uncorrected and barometer corrected results from the cosmic-ray station at Chacaltaya, Bolivia, from January through December 1970 are given in tabular form. Normalized graphs of the neutron monitor are also given. Author (NSA)

N72-23862# Aerospace Corp., El Segundo, Calif. Lab. Operations.
POSITION MEASUREMENTS OF MAIN-LINE OH/IR STARS Research Report, Jan. - Jul. 1971
William J. Wilson and Ellen G. Hardebeck (Calif. Inst. of Tech.) 30 Dec. 1971 18 p refs
(Contract F04701-71-C-0172)
(AD-736439; TR-0172(2230-20)-11; SAMSO-TR-72-2) Avail: NTIS CSCL 03/1

Interferometer position measurements are reported for five main-line OH emission sources associated with infrared stars. The results of the measurements show that in all cases the 1667-MHz OH emission originates from the stellar position, with typical errors of plus or minus 5 to plus or minus 15 seconds of arc. In addition to the OH/IR star observations, the position of the main-line OH source OH2019-37 (ON-2) was measured. This source was found not to coincide with the red star BC Cyg as previous authors have suggested, but instead to be associated with an HII region. Author (GRA)

N72-23350*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE STABILITY OF TANGENTIAL DISCONTINUITIES
Thomas Birmingham *In its* Significant Accomplishments in Sci., 1970 1972 p 134-139 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23351*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDROMAGNETIC HEATING IN THE SOLAR WIND
Richard Hartle *In its* Significant Accomplishments in Sci., 1970 1972 p 140-143 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23352*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR WIND HEAT FLOW

Jack Scudder *In its* Significant Accomplishments in Sci., 1970 1972 p 144-148 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23355*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LONG DURATION SOLAR ACTIVE REGIONS
Donald Heath *In its* Significant Accomplishments in Sci., 1970 1972 p 159-163 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23356*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
QUASI-SEASONAL VARIATION IN THE SUN
Sushil Chandra *In its* Significant Accomplishments in Sci., 1970 1972 p 164-170 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23357*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR X-RAYS AND PARTICLE ACCELERATION
Kenneth Frost *In its* Significant Accomplishments in Sci., 1970 1972 p 171-175 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23392*# Scripta Technica, Inc., Washington, D.C.
COSMIC RAY VARIATIONS DURING PCA TYPE ABSORPTION
I. D. Kozin *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 74-77 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23393*# Scripta Technica, Inc., Washington, D.C.
STATISTICAL ACCURACY OF COSMIC RADIATION NEUTRON COMPONENT RECORDERS
L. I. Dorman and I. A. Pimenov *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 79-81 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23398*# Scripta Technica, Inc., Washington, D.C.
VARIATIONS OF COSMIC RAYS ASSOCIATED WITH CHROMOSPHERIC FLARES ON THE SUN
I. D. Kozin *In its* Morphology of the Quiet and Disturbed Ionosphere May 1972 p 113-116 refs (See N72-23378 14-13)
Avail: NTIS HC $3.00 CSCL 03B

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N72-23863 California Inst. of Tech., Pasadena.
ALIGNMENT OF INTERSTELLAR GRAINS Ph.D. Thesis
Mark Parnes Goldstein 1971 134 p
Avail: Univ. Microfilms Order No. 71-17379

The alignment of interstellar dust grains was calculated with respect to the magnetic field of the galaxy, for several values of magnetic field strength, internal grain temperature, and grain shape. The following items, which affect alignment, were investigated: (1) dissipative magnetic torque, (2) collisions of the grains with interstellar hydrogen, and (3) the nonzero internal temperature of the grain. A Fokker-Planck equation was obtained; its solution provides the probability distribution of grain orientation. Using this distribution, the degrees of alignment were calculated. Dissert. Abstr.

N72-23864 Indiana Univ., Bloomington.
HEAVY METAL ABUNDANCES IN S-STARS Ph.D. Thesis
William Hackos, Jr. 1970 151 p
Avail: Univ. Microfilms Order No. 71-17445

Two S-stars, the long period variable R Cygni and the nonvarying S-star HD 35155, were studied in the blue region of the spectrum in order to determine atomic abundances of the iron group metals and heavy metals. Of special interest were the abundances of Tc-99 and Nb-93, which provide a time scale to estimate the age of the material in the atmosphere. The resulting abundances were nearly the same as solar abundances for Arcturus. For both HD 35155 and R Cygni it was found that heavy element abundances were enhanced in a way consistent with neutron capture theory. For both S-stars the iron group elements were found to have abnormal abundances compared with solar abundances. The Nb and Tc abundances for HD 35155 suggest that material fresh from neutron exposure is no longer being brought to the surface. The Nb and Tc abundances for R Cyg yield ambiguous results. Dissert. Abstr.

N72-23865 Indiana Univ., Bloomington.
A LINE BLANKETED MODEL ATMOSPHERE FOR EPSILON VIRGINIS (HD 113226) Ph.D. Thesis
Thomas Edward Morgan 1971 119 p
Avail: Univ. Microfilms Order No. 71-17451

The problem of line blanketing in the atmospheres of stars with effective temperatures less than about 8000 K was studied by means of several techniques, all sharing a characteristic statistical approach in which the identity of individual absorption lines is not preserved when the line absorption is included in the calculation of model stellar atmospheres. The LTE model bracketing the previously derived parameters of epsilon Vir was computed. The effects of blanketing on predicted quantities were studied by means of the continuum energy distribution, board and intermediate band multicolor magnitudes, and profiles of several strong absorption lines. The effect of line blanketing on the temperature-pressure structure of the models was studied. Dissert. Abstr.

N72-23866 Wisconsin Univ., Madison.
THE LIFE SPANS OF CONDENSATIONS IN PLANETARY NEBULAE Ph.D. Thesis
Albert Victor Holm 1971 92 p
Avail: Univ. Microfilms Order No. 71-14144

It is shown that, under certain conditions, neutral condensations formed in a young planetary nebula and not held together by gravitational or magnetic forces can survive for a time span comparable with the ages of old planetaries in which condensations are observed. Model planetary nebulae containing neutral condensations of gas in pressure equilibrium with the ionized medium were evolved numerically. The primary purpose for the calculations to determine whether such condensations can exist for a period of time comparable with the age of a planetary nebula and to determine the parameters of the nebulae which contain the most enduring condensations. A number of simplifying assumptions were made. Dissert. Abstr.

N72-23867 Wisconsin Univ., Madison.
B-TYPE STARS WITH DISCREPANT COLORS Ph.D. Thesis
Michael Robert Molnar 1971 92 p
Avail: Univ. Microfilms Order No. 71-14156

The physical characteristics of the color spectrum discrepant stars were investigated by observing the stars energy distributions, line profiles, and equivalent widths of prominent spectral lines. These data were used in a model atmosphere analysis and abundance determination. The observing program was carried out using a rapid scanner mounted on a 36-inch telescope to

obtain monochromatic magnitudes of the continuum. Scans were made to search for evidence of the 3422 He I discontinuity (none was found), which would have indicated a high helium abundance. The line profiles and equivalent widths were obtained from Coude spectra, and classification spectra were obtained to better define the class and search for new color spectrum discrepant stars. The diffusion mechanism, which predicts surface abundance anomalies through a combination of gravitational settling and radiative pressure, is suggested as an explanation for the stars. Dissert. Abstr.

N72-23868 Cornell Univ., Ithaca, N.Y.
OBSERVATIONS OF INTERSTELLAR MOLECULAR HYDROGEN AND MEASUREMENTS OF HYDROGEN AND HELIUM FLUXES FROM PLANETARY NEBULAE Ph.D.Thesis
Theodore Raymond Gull 1971 301 p
Avail: Univ. Microfilms Order No. 71-176042

An automated Fabry-Perot interferometer was developed for telescope use to detect very weak emission lines originating from extended regions in space. The He 10830 A and the P12 8750.36 A line fluxes were measured in six planetary nebulae; upper limits to the sky background continuum in the near infrared were established. No emission features attributed to H2 were detected in any of many regions observed. The results for the Orion nebula do not agree with the earlier interpretation that the 0(2)3-0 line of H2 might be present in the spectrum of a dark cloud located near the Trapezium. Observations were made in the vicinity of xi Persei; no H2 emission lines are present. Observations were also done in IC5146 and NGC2264. Emission features were detected in all of the spectra recorded with a narrow band filter centered at 8748 A as the preselector; however, the features are due to lines of the 7-3 band of atmospheric OH. Fluxes of the He 10830 A line were combined with fluxes of the He 5876 A line to give a ratio R = I(10830 A)/I(5876 A) for several planetary nebulae. Extinction curves were constructed by comparing the radio-predicted P12 and other hydrogen line fluxes to the observed line fluxes.
Dissert. Abstr.

N72-23869 Oklahoma Univ., Norman.
THE STRUCTURE AND CIRCULATION OF THE ATMOSPHERE OF VENUS Ph.D. Thesis
David Eugene Pitts 1971 111 p
Avail: Univ. Microfilms Order No. 71-17049

The Mariner 2, Venera 4, Mariner 5, Venera 5, and Venera 6 flybys and entry capsules increased the knowledge of Venus atmosphere. All these data are reviewed enabling many of the earlier models to be rejected and two new model atmospheres to be constructed. The necessity for two model atmospheres exists because the chemical content of the clouds is still in question with the most probable candidates being: H2O - ice, and dust. Other major uncertainties still exist, one of which is the horizontal temperature structure. An anelastic, compressible, steady state circulation model is developed, which accounts for solar heating occurring at the top of the cloud layer. The phase effect of temperature in the lower atmosphere is determined to be nonexistent. The model developed by Hess (1968) is the only top heated model with which these results agree. A temperature phase effect is predicted for the cloud tops, which as yet has never been detected. Dissert. Abstr.

N72-23870 City Univ. of New York.
NONLINEAR NUCLEAR-ENERGIZED STELLAR PULSATIONS Ph.D. Thesis.
Stephen Gene Ungar 1971 302 p
Avail: Univ. Microfilms Order No. 71-20946

Nuclear-energized pulsations were investigated as a proposed mechanism for observed variations in light and radial velocity curves for beta Cepheid stars. Models were constructed using a fully nonlinear hydrodynamic computer code. For 15-solar-mass, main sequence models with helium-enriched envelopes, pulsational instability was found to induce mass loss at the rate of about 0.00005 solar mass per year in the form of ejected shells. The final shell velocities approach 1000 km/sec. Suppression of mass loss by computational techniques gives rise to models whose radial velocity curves display periods and structure similar to those of beta Cepheid stars. Dissert. Abstr.

N72-23871 California Univ., Berkeley.
EVOLUTION OF EARLY-TYPE CLOSE BINARY SYSTEMS Ph.D. Thesis
Robert Stanley Benson 1970 94 p
Avail: Univ. Microfilms Order No. 71-20773

A modified version of the Berkeley evolutionary program was used to compute models approximating the nonsperical components of a close binary system, and to follow their evolution during mass exchange. Both components were assumed to always be in uniform rotation at a rate synchronous with their orbital motion. The primary fills its Roche lobe after main sequence hydrogen burning has reduced the central hydrogen content to about half its initial value. The rate of mass exchange is then determined by an iterative scheme such that the radius of the primary is equal to that of the Roche lobe to one part in 1000. All material leaving the primary flows isothermally to the surface of the secondary. Discussion of structural changes during mass exchange reveals that the growth of the secondary's radius is directly related to the large difference in the Kelvin time scales for the two stars. Dissert. Abstr.

N72-23872 California Univ., Berkeley.
STRESS-DEFORMATION STUDY OF A SIMULATED LUNAR SOIL Ph.D. Thesis
Laith Ismail Namiq 1970 239 p
Avail: Univ. Microfilms Order No. 71-20872

The mechanical properties of lunar soil were studied and analytical tools were developed which would be useful for terrestrial applications. A lunar soil simulant was prepared which behaves under applied load similarly to actual lunar soil. An extensive analysis of the properties and behavior of this simulant under terrestrial conditions was made and the results were transferred to the lunar surface by means of an analytical model. The method of study used was an analytical-experimental approach which led to the formulation and solution of a boundary value problem. Experimental work included laboratory measurements of strength, stress-strain, and compressibility parameters, and performance of model plate load tests. Analytical work included: (1) mathematical description of the strength, stress-strain, and compressibility parameters, including their dependence on soil density (2) use of the finite element method to simulate the model plate load tests for both terrestrial and lunar gravity conditions. Dissert. Abstr.

N72-23873 California Univ., Berkeley.
EVOLUTIONARY MODELS OF STARS OF 15 AND 30 SOLAR MASSES Ph.D. Thesis
Erik Elgar Simpson 1970 53 p
Avail: Univ. Microfilms Order No. 71-20909

Evolutionary models were computed for stars of 15 and 30 solar mass with a composition given by the mass abundances X = 0.75, Y = 0.23, Z = 0.02. Parallel calculations were carried out with, and without, allowance for semiconvection or full convection in intermediate mass shells. After the main sequence phases the models with intermediate mixing develop fully convective shells that after the behavior of the models during helium burning. The models with the convective shells spend much of their helium-burning lifetimes as blue supergiants, while the models without convective shells rapidly become red supergiants. From an examination of the observations of h and chi Persei, it is concluded that the convective shell models are more likely to be physically correct. Dissert. Abstr.

N72-23874 Wisconsin Univ., Madison.
ULTRAVIOLET OBSERVATIONS OF MARS MADE BY THE ORBITING ASTRONOMICAL OBSERVATORY Ph.D. Thesis

John James Caldwell 1971 136 p
Avail: Univ. Microfilms Order No. 71-14129

High quality scans of Mars (four at phase angle 34.5 deg and one at phase angle 26.8 deg) obtained by the Orbiting Astronomical Observatory were used to construct albedo curves from 2000 A to 3700 A. The solar spectrum was used for the short wavelength region of the curves and the G star, zeta Her, was used for the long wavelength region. The albedo curves show an increase toward shorter wavelengths. When the reflectivity of the known amount of atmospheric CO2 is accounted for, the excess reflectivity observed shows a generally smooth decrease. It is concluded that the published reflectivities of carbon suboxide polymers and of limonite cannot match the surface reflectivity, with limonite being in less severe disagreement. Upper limits were placed on abundances of some plausible upper atmosphere gases capable of resonance scattering or fluorescence. Dissert. Abstr.

N72-23875 Wisconsin Univ., Madison.
STELLAR INTERFEROMETRY FOR FAINT ASTRONOMICAL OBJECTS Ph.D. Thesis
Joseph Henry Davidson 1971 124 p
Avail: Univ. Microfilms Order No. 71-16068

A system of photoelectric detection of fringes from a Fizeau interferometer was used to measure the parameters of three visual binary systems: eta 1 and eta 2 Lyr and eta Ari. Calculations were made based on a study of noise in a series of experimental measurements with slit separations from 2.5 to 132 cm; these indicate that position angle can be determined within 3 deg, separation within 10%, and delta m within 0.5 magnitude for a binary system, which satisfies given relations. Measurements made with this technique can be used to derive better values for astrophysical constants. The technique may also be useful in the infrared region, for which there is no imaging device to distinguish point sources from extended ones.
Dissert. Abstr.

N72-23876 Florida Univ., Gainesville.
RADIO INVESTIGATIONS OF CLUSTERS OF GALAXIES Ph.D. Thesis
Frank Forbes Donivan, Jr. 1970 121 p
Avail: Univ. Microfilms Order No. 71-16778

The results are presented for radio frequency observations of the Coma and Hercules clusters of galaxies (Abell nos. 1656 and 2151). Antenna temperature contour maps were constructed from observations made with the 1,000-foot Arecibo dish at frequencies of 195, 318, and 611 MHz. Analysis of the contour maps indicates the lack of a detectable distributed component of emission from the Coma cluster. Although the Hercules cluster is located in the galactic spur, the contour maps at 195 and 318 MHz both contain one contour interval which encloses the cluster. These contour intervals are much larger than the optical boundaries of the cluster, and may be the long-sought-after distributed component of emission. Dissert. Abstr.

N72-23877 Florida Univ., Gainesville.
LONG BASELINE INTERFEROMETRY OF JUPITER'S DECAMETRIC RADIATION Ph.D. Thesis
George Wayne Brown 1970 246 p
Avail: Univ. Microfilms Order No. 71-16767

A long baseline interferometric study of Jupiter's radiation was characterized by three subjects: (1) Tape-recorded surveys of simultaneous L and S bursts from Jupiter using an 18-MHz interferometer with a baseline of 218 Km. (2) A statistical analysis was made of the bursts. (3) The interferometer was utilized to calculate an upper limit on the size of the burst sources. After digitizing selected bursts, cross correlation functions were calculated by computer for seven S sub 1 bursts, fifteen S sub 2, and four sections of continuous L bursts recorded simultaneously at St. Peterburg, Florida and Santiago, Chile.
Dissert. Abstr.

N72-23878 Stanford Univ., Calif.
A STUDY OF 21 CM ABSORPTION BY NEUTRAL HYDROGEN IN THE GALAXY Ph.D. Thesis
Michael Paul Hughes 1970 182 p
Avail: Univ. Microfilms Order No. 71-12925

The analysis is presented for the hydrogen line spectra of 105 small-diameter radio sources, most of which lie outside our galaxy. The spectra were measured with a two-element interferometer. Most sources stronger than five flux units were observed. The frequency resolution was generally 4 kHz which corresponds to a velocity resolution of 0.81 km/sec. The spectra of many sources between 30 and 50 deg from the galactic plane contain evidence of absorption by neutral hydrogen in our galaxy. For a crude model of the interstellar medium, in which part of the gas is in cool clouds and the remainder is much hotter, it is shown that the ratio of the area under the absorption spectrum to that under the emission spectrum is a measure of the fraction of the mass in the cool clouds. Two new distance estimates are presented for the Cetus Arc, a galactic spur region where anomalously high absorption is found. Eight sources that lie inside our galaxy, and which are included in this study are considered briefly. A study of the radio source 3C 274, in which systematic effects were very carefully eliminated, is also presented. Dissert. Abstr.

N72-23879 Cornell Univ., Ithaca, N.Y.
METER WAVELENGTH OBSERVATIONS OF GALACTIC RADIO SOURCES AND THE GALACTIC DISK RADIATION Ph.D. Thesis
Alan deSchweinitz Parrish 1971 149 p
Avail: Univ. Microfilms Order No. 71-17119

A 1000 foot diameter radio telescope was used to observe the continuum emission of galactic sources at low radio frequencies. The following sources were observed: W49, W51, W56, NGC 1499, IC 410, NGC 2175, NGC 2244, and Orion A. Observations were carried out at seven frequencies: 53, 65, 74, 89, 111, 196, and 318 MHz. Arrangements were made to obtain data on several of these frequencies simultaneously. Flux densities of the observed sources are presented at the low frequencies. The data was also analyzed to obtain an estimate of the electron temperature of each thermal source, as well as the brightness temperature level of the nonthermal radiation in the line of sight to and beyond each source. The analysis procedure involved using models of the sources to generate theoretical spectra for various values of two free parameters: the electron temperature and the background brightness temperature level.
Dissert. Abstr.

N72-23880 Case Western Reserve Univ., Cleveland, Ohio.
OB STARS AND GALACTIC STRUCTURE: THE PERSEUS SPIRAL ARM Ph.D. Thesis
Glenn Alden Snyder 1970 112 p
Avail: Univ. Microfilms Order No. 71-19058

Photoelectric UBV photometry and MK spectral classification were obtained for OB stars in region LF 5. An investigation of absolute magnitudes and intrinsic colors reveals that there is a dependence of absolute magnitude on apparent magnitude, and a possible change in the classification system at B = 10.5, for the OB stars of the LS Catalogue in this region. To take this effect into account, new calibrations of M sub V and (b-v) sub 0 for OB stars, which include a photometric criterion, are given. An analysis of radial velocity in and near LF 5 shows that the stars are following the Schmidt rotation model velocity characteristics of their region of peak density, but stars nearer and farther than the peak show motions indicating expansion or shearing along the arm. The H I in the region appears to lie about 750 pc farther than the stars, and to exhibit the same expansion or shearing motions. The resulting picture of the Perseus spiral arm was compared to the predictions of the predictions of the density wave theory of spiral structure. Dissert. Abstr.

N72-23881 Case Western Reserve Univ., Cleveland, Ohio.
THE STELLAR DISTRIBUTION IN CYGNUS Ph.D. Thesis
Mark Ray Chartrand, III 1970 182 p

Avail: Univ. Microfilms Order No. 71-18975

Data from a catalogue of objective prism spectral types and photographic V magnitudes for approximately 5400 stars to V = 11.5 were used to study the distribution of common stars in the region 1 = 70 to 100 deg in a band 2 deg on each side of the galactic equator. The surface distributions of several spectral groups are discussed in detail. The space density of stars was derived as a function of distance for several areas. A concentration of B7-A1 stars was found at in a long ridge at l approximately = 75 to 80 deg extending from r approximately = 200 pc to r approximately = 800 pc. The surface distribution of early B stars indicates that B stars are also concentrated in this area. The radio of main sequence A stars to giant K stars was derived as a function of distance in several regions. This value, over the entire region, when both types are taken to V = 10.0, is 2.2. Based on surface distributions, a high value of dA/gK = 9.0 was found at l = 89 deg. The maximum space density of early B and B7-A1 stars lies near and parallel to the inner edge (toward the galactic center) of a model local spiral arm. Dissert. Abstr.

N72-23882 Wisconsin Univ., Madison.
AN INVESTIGATION INTO THE OPTICAL FLUORESCENCE OF INTERSTELLAR HI Ph.D. Thesis
Ronald Jay Reynolds 1971 139 p
Avail: Univ. Microfilms Order No. 71-16896

A search was conducted for H beta emission resulting from ionization of interstellar hydrogen and hydrogen recombination using a 2 in diameter Fabry-Perot spectrometer at the Coude focus of a 36 in telescope. Observations were made near the directions of four pulsars (PSR 0532, PSR 1508, PSR 1541, and PSR 1642) between November 1969 and June 1970. Emissions with fluxes from 40,000 to 400,000 photons/sq cm sec ster were detected in three of the directions. The data indicate both an average ionization rate (assuming steady state) of about 10 to the -14th power/H-atom sec for the interstellar hydrogen and, depending on the particular direction, temperatures between 1000 K and 10,000 K for the emitting regions.
Dissert. Abstr.

N72-23883 Wisconsin Univ., Madison.
PART 1: OBSERVATIONS OF THE BRIGHTNESS AND POLARIZATION OF THE OUTER CORONA DURING THE 12 NOVEMBER 1966 TOTAL ECLIPSE OF THE SUN. PART 2: THE USE OF EXTINCTION FROM HIGH ALTITUDE BALLOONS AS A PROBE OF THE ATMOSPHERIC AEROSOLS Ph.D. Thesis
Theodore John Pepin 1970 100 p
Avail: Univ. Microfilms Order No. 71-18798

An experiment is described in which photographs of the solar corona were obtained from a camera flown on the NASA CV-990 at an altitude of 40,000 feet during the November 12, 1966 total eclipse of the sun. The absolute brightness, polarization, and the direction of polarization of the solar corona between 3.5 and 13 solar radii were determined from these photographs. A significant polarized component was found in this region, the structure of which is closely correlated with features in the inner corona. Comparisons are made with the July 20, 1963 and May 30, 1965 eclipses, and evidence is given for changes in brightness of the coronal light between these eclipses. A simple instrument is described which measures the intensity of the solar radiation in four spectral regions. Data from the atmospheric aerosols determined from these measurements are presented. Evidence is given for a time variation of aerosols at high altitude.
Dissert. Abstr.

N72-23884 Rochester Univ., N.Y.
SOME INTRINSIC PROPERTIES OF CARBON STARS Ph.D. Thesis
Harvey Brian Richer 1971 108 p
Avail: Univ. Microfilms Order No. 71-22315

By employing spectrograms of moderate dispersion in the infrared region, two dimensional classification scheme involving temperature and luminosity was established for carbon stars. Intrinsic colors of the spectral subtypes were determined and these were used to construct a color-color diagram which separated out the early and late-type carbon stars. A galactic rotation solution, using radial velocities and intrinsic colors, yielded a mean absolute magnitude of -2.7 for the middle carbon stars. This value was employed to construct the M sub bol - log T sub e diagram for carbon stars. They were found to form an extension of the giant branch to cooler temperature. Radial velocities were determined for 78 carbon stars using the infrared spectra. Dissert. Abstr.

N72-23885*# California Inst. of Tech., Pasadena. Seismological Lab.
ORIGIN, EVOLUTION AND PRESENT THERMAL STATE OF THE MOON
Thomas C. Hanks and Don L. Anderson [1972] 49 p refs
(Grant NGL-05-002-069)
(NASA-CR-126558; Contrib-2145) Avail: NTIS HC $4.50 CSCL 03B

The relative absence of lunar volcanism in the last 3 b.y. and the Apollo 15 heat flow measurement suggest that present-day temperatures in the moon are approximately steady state to depths of 100 km. An exponential distribution of heat sources with depth is scaled by equating the surface heat flow to the integrated heat production of this exterior shell. Presumed present-day interior temperatures and the present-day surface heat flow of 30 ergs/cm2-sec are obtained. The estimated homogeneous concentrations of U, the chemistry of the lunar surface material and inferences to modest depth, and the short accretion time of the moon necessary to provide large-scale differentiation at 4.6 AE suggest that the moon had its origin in the rapid accretion of compounds first condensing from the protoplanetary nebula. The present thermal state of the moon may involve at least some partial melting through all the lunar interior deeper than 200 km. Such a thermal configuration is inconsistent neither with temperatures inferred from electrical conductivity studies nor with the nonhydrostatic shape of the moon. Author

N72-23886*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
POLYNOMIAL FILTER ESTIMATION OF RANGE AND RANGE RATE FOR TERMINAL RENDEZVOUS
R. Philips 7 Aug. 1970 36 p refs Sponsored by NASA
(NASA-CR-126400; Skylab-23A-Memo-1-70) Avail: NTIS HC $4.00 CSCL 22A

A study was made of a polynomial filter for computing range rate information from CSM VHF range data. The filter's performance during the terminal phase of the rendezvous is discussed. Two modifications of the filter were also made and tested. A manual terminal rendezvous was simulated and desired accuracies were achieved for vehicles on an intercept trajectory, except for short periods following each braking maneuver when the estimated range rate was initially in error by the magnitude of the burn. Author

N72-23887# Sternwarte Pulsnitz (West Germany).
GASES ON THE SURFACE OF THE MOON? [GASE AUF DER MONDOBERFLAECHE?]
J. Classen 1970 15 p refs In GERMAN; ENGLISH summary
(Publ-8) Avail: NTIS HC $3.00

The transient phenomena observed occasionally on the moon can be most easily explained by luminescent gases which sometimes emanate the interior of the moon. Frequently, the lunar transient events have decided colours. Some gases and vapours are investigated which, when luminescing, show similar colours as the lunar transient events. Author

N72-23888*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYTIC SHORT PERIOD LUNAR AND SOLAR PERTURBATIONS OF ARTIFICIAL SATELLITES

David Fisher Mar. 1972 32 p refs Submitted for publication
(NASA-TM-X-65869; X-552-72-83) Avail: NTIS HC $3.75 CSCL 22C

A short period luni-solar theory was generalized for application to arbitrary obliquity of the ecliptic and inclination of the moon's orbit to the ecliptic. Analytic first order lunar perturbations to the elements were derived. The theory is illustrated by an application to the communication satellite Intelsat 3F3. Author

N72-23889*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ULTRAVIOLET FLUX ENVELOPES OF MAIN-SEQUENCE B STARS
Anne B. Underhill Apr. 1972 48 p refs
(NASA-TM-X-65873; X-670-72-102) Avail: NTIS HC $4.50 CSCL 03B

Flux envelopes on an absolute energy scale from 1100 to 6000 A prepared from OAO-2 scans and from published ground-based material are presented for gamma Leporis, B0.5 5 eta Ursae Majoris, B3 5, gamma Ursae Majoris, A0 5, and alpha Lyrae, A0 5, and for alpha Canis Majoris A1 5 from rocket scans. These, with already published flux envelopes for Zeta Draconis, B6 3, and alpha Leonis, B7 5 (Underhill 1972) are intercompared and compared with reference flux envelopes predicted by LTE theory from lightly line-blanketed model atmospheres. A considerable line blocking occurs at wavelengths shortward of 3000 A with respect to the theoretical continuous spectra. The line blocking may be as much as 50 per cent at 1500 A and between 1500 A and 2500 A it is comparable to that which exists in the sun between 3000 A and 4000 A. Although gamma Urase Majoris, alpha Lyrae and alpha Canis Majoris have very similar visible spectra when viewed at low resolution, their ultraviolet spectra are significantly different, in particular alpha Lyrae shows an ultraviolet excess. Author

N72-23890*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MEAN ELEMENTS OF GEOS-1 AND GEOS-2
B. C. Douglas (Wolf Res. and Develop. Corp., Riverdale, Md.), J. G. Marsh, and N. E. Mullins (Wolf Res. and Develop. Corp., Riverdale, Md.) Mar. 1972 18 p refs Submitted for publication
(NASA-TM-X-65870; X-553-72-85) Avail: NTIS HC $3.00 CSCL 22C

A combined analytical-numerical procedure for determining precise mean orbital elements is presented and applied to the orbits of GEOS-1 and GEOS-2. The precision of the mean semi-major axes of these orbits is a few tens of centimeters when optical flash data is used to determine two-day orbital arcs. Four-day Minitrack orbits give mean semi-major axes of a few meters precision. The mean orientation parameters are obtained to a precision of about 0.1 sec (about 3m) or better from the optical orbits. This precision is adequate for determinations of tidal parameters, particularly in the case of GEOS-2, where the tidal perturbation of the inclination is 10 sec. Author

N72-23891*# Boeing Co., Seattle, Wash. Space Div.
ECLIPSE COOLING OF SELECTED LUNAR FEATURES
R. W. Shorthill, J. M. Saari, F. E. Baird, and J. R. LeCompte Mar. 1970 454 p refs
(Contract NAS9-9794)
(NASA-CR-115563) Avail: NTIS HC $24.75 CSCL 03B

Thermal measurements were made in the 10 to 12 micron band of the lunar surface during the total eclipse of December 19, 1964. A normalized differential thermal contour map is included, showing the location of the thermal anomalies or hot spots on the disk and the eclipse cooling curves of 400 sites, of which more than 300 were hot spots. The eclipse cooling data is compared to a particulate thermophysical model of the soil. Author

N72-23892*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A LIST OF SOME BRIGHT OBJECTS WHICH S-052 CAN OBSERVE
James P. McQuire 11 Feb. 1972 22 p ref
(NASA-TM-X-64656) Avail: NTIS HC $3.25 CSCL 03A

In order to find out the precise orientation of the photographs obtained by the High Altitude Observatory's ATM white light coronagraph, celestial objects must appear on each roll of film. A list of such bright objects and the times during which they can be observed is presented. Author

N72-23893# Lockheed Missiles and Space Co., Palo Alto, Calif.
METHODOLOGICAL ERRORS IN CONSTRUCTING A LOCAL VERTICAL
A. V. Pavlov and V. D. Permiakov [1972] 6 p refs Transl. into ENGLISH from Kosm. Issled. (USSR), v. 9, no. 6, 1971 p 867-872
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A classification is proposed for methodological errors in constructing a local vertical for the orientation of orbital space vehicles. The method of determining the limiting error is examined. On the basis of this, the limiting values of the error were determined as a function of altitude for 0.95 confidence. Author

N72-23894# Academy of Sciences (USSR), Moscow.
COSMIC DATA: MONTHLY REVIEW NO. 5, MAY 1971
15 Dec. 1971 73 p In RUSSIAN; ENGLISH summary
Avail: NTIS HC $5.75

Observations on the electric and magnetic states of the upper atmosphere and on solar activity are presented for May 1971. Data on geomagnetic variations, ionospheric propagation, cosmic rays, and earth currents are included. Author

N72-23895*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERSTELLAR LINES IN THE ULTRAVIOLET SPECTRUM OF ZETA OPH
Andrew M. Smith Apr. 1972 55 p refs Submitted for publication
(NASA-TM-X-65883; X-672-72-122) Avail: NTIS HC $4.75 CSCL 03B

Interstellar lines arising in carbon, oxygen, silicon, and sulfur observed in the ultraviolet spectrum of zeta Oph by rocket spectrographic techniques were analyzed. Within a factor of 10, the abundances of c(+), neutral O, and Si(+) outside the H II region surrounding zeta Oph, relative to the hydrogen abundance, are equal to solar values. The lines in neutral C and S(+) imply that the interstellar matter is distributed among several clouds as indicated by high resolution visible spectra. It is suggested that the excited C(+) ions are inside the Stromgren sphere where proton densities equal to or greater than 0.0022 cm can collisionally excite the ions at sufficient rates. Stellar absorption lines of C IV (1548.2, 1550.8A) and N V (1238.8, 1242.8A) were observed shifted to lower wavelengths, indicating stellar mass loss. Author

N72-23896*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LUNAR EPHEMERIS AND SELENOGRAPHIC COORDINATES OF THE EARTH AND SUN FOR 1971 AND 1972
Ann D. Hartung Washington 1972 437 p refs
(NASA-SP-3057) Avail: NTIS HC $6.00 CSCL 03A

Ephemeris data are presented for each month of 1971 and 1972 to provide a time history of lunar coordinates and related geometric information. A NASA Manned Spacecraft Center modification of the Jet Propulsion Laboratory ephemeris tape was used to calculate and plot coordinates of the earth, moon, and sun. The ephemeris is referenced to the mean vernal equinox at the nearest beginning of a Besselian year. Therefore,

the reference equinox changes from one year to the next between 30 June and 1 July. The apparent discontinuity in the data is not noticeable in the graphical presentation, but can be observed in the digital output. The mean equator of epoch is used in all cases. The computer program used to compute and plot the ephemeris data is described. Author

N72-23897*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LUNAR EPHEMERIS AND SELENOGRAPHIC COORDINATES OF THE EARTH AND SUN FOR 1973 AND 1974
Ann D. Hartung Washington 1972 442 p refs
(NASA-SP-3058) Avail: NTIS HC $6.00 CSCL 03A

Ephemeris data are presented for each month of 1973 and 1974 to provide a time history of lunar coordinates and related geometric information. A NASA Manned Spacecraft Center modification of the Jet Propulsion Laboratory ephemeris tape was used to calculate and plot coordinates of the earth, moon, and sun. The ephemeris is referenced to the mean vernal equinox at the nearest beginning of a Besselian year. Therefore, the reference equinox changes from one year to the next between 30 June and 1 July. The apparent discontinuity in the data is not noticeable in the graphical presentation, but can be observed in the digital output. The mean equator of epoch is used in all cases. The computer program used to compute and plot the ephemeris data is described. Author

N72-23898*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PRELIMINARY MISSION DESIGNS FOR JUPITER ORBITER MISSIONS
Byron L. Swenson, Edward L. Tindle, and Larry A. Manning Washington May 1972 48 p refs
(NASA-TM-X-2565; A-4276) Avail: NTIS HC $3.00 CSCL 22A

Preliminary designs for unmanned orbital exploration missions to Jupiter are examined, and the operational options and systems requirements consistent with the major scientific goals of the mission are summarized. In general, each mission design provides repeated measurements of the interaction of Jupiter with the solar media, encounters at least two Galilean satellites with multiple encounters with at least one satellite at distances which allow photography with resolutions of at least 10 km; provides at least 10 orbital maps of the field and particle environment surrounding Jupiter, and provides synoptic observations of Jupiter over a range of wavelengths and various degrees of photographic coverage with resolutions of 300 to 30 km. Author

N72-23899# Mons Univ. (Belgium). Faculty of Sciences.
ULTRAVIOLET SPECTROPHOTOMETRIC SURVEY OF THE SKY. DETERMINATION OF THE OPTICAL AXIS TRAJECTORY: STATISTICAL METHOD [LEVE SPECTROPHOTOMETRIQUE DU CIEL DANS L'ULTRAVIOLET. DETERMINATION DE LA TRAJECTOIRE DE L'AXE OPTIQUE. METHODE STATISTIQUE]
E. Blondelot [1971] 11 p In FRENCH
(Commun-20) Avail: NTIS HC $3.00

A statistical method is described for the determination of the optical axis in ultraviolet spectrophotometric surveying of stars. Author (ESRO)

N72-23900# Aerospace Corp., El Segundo, Calif. Engineering Science Operations.
TRACE66 TRAJECTORY ANALYSIS AND ORBIT DETERMINATION PROGRAM. VOLUME 1: GENERAL PROGRAM OBJECTS, DESCRIPTION, AND SUMMARY Technical Report, Jul. 1970 - Jul. 1971
Robert H. Prislin, Dennis C. Walker, and Robert J. Mercer 15 Aug. 1971 57 p refs
(Contract F04701-71-C-0172; F04701-71-C-0172)
(AD-735301; TR-0059(9320)-1-Vol-1; SAMSO-TR-71-141-Vol-1) Avail: NTIS CSCL 22/3

The TRACE66 Trajectory Analysis and Orbit Determination Program is a general-purpose orbital analysis program. It was written specifically for the CDC 6000 series computers to assist the Aerospace Corporation personnel in the analysis and design of satellite orbits and tracking systems. Volume I is a reference for general program objectives; it describes and summarizes the program. A comprehensive description of its areas of application is presented. An overview of the major capabilities of the program is emphasized. Author (GRA)

N72-23901# Aerospace Corp., El Segundo, Calif. Lab. Operations.
DIFFERENTIAL THERMAL ANALYSIS AND GAS RELEASE STUDIES OF APOLLO 11 SAMPLES, DECEMBER 1969 - JANUARY 1970
Frank M. Wachi, Donald E. Gilmartin, John Oro (Houston Univ.), and William S. Updegrove (Houston Univ.) 15 Nov. 1971 28 p refs
(Contract F04701-71-C-0172)
(AD-736428; TR-0172(2250-40)-4; SAMSO-TR-71-313) Avail: NTIS CSCL 03/2

The liquidus-solidus behavior of Apollo 11 lunar fines and the evolution characteristics of CO, N2, He, Ne, and Ar were investigated by use of the combined techniques of high-vacuum differential thermal analysis (DTA) and mass spectrometry between 100 and 1500 C. The DTA thermogram has shown that the lunar fines undergo partial melting over a broad range of temperature from about 915 to 1300 C, with a significant initial melting of glassy and crystalline components within the fines at about 1140C. The thermal evolution curves for the noble gases have indicated that these gases come from several sources, the principal sources being the solar wind, radiogenic decay reactions, and spallation processes. Author (GRA)

N72-23902# Aerospace Corp., El Segundo, Calif.
ASTRONOMY RESEARCH AT THE AEROSPACE CORPORATION Research Report, Jan. - Dec. 1971
George A. Paulikas 30 Dec. 1971 24 p
(Contract F04701-71-C-0172)
(AD-736442; TR-0172(2260-01)-1; SAMSO-TR-72-7) Avail: NTIS CSCL 03/2

A review is given of the astronomy research carried out by the Space Physics Laboratory and the Electronics Research Laboratory during January 1971 through December 1971. Author (GRA)

N72-23337*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STABILITY OF THE VENUS IONOPAUSE
Jay Herman *In its* Significant Accomplishments in Sci., 1970 1972 p 63-70 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23338*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ADIABATIC INVARIANCE
David Stern *In its* Significant Accomplishments in Sci., 1970 1972 p 71-74 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23342*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MASCON DISTRIBUTION ON THE MOON
James Murphy *In its* Significant Accomplishments in Sci., 1970 1972 p 92-97 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23343*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEARCH FOR MAGNETIC MONOPOLES IN THE MOON

Kenneth Schatten *In its* Significant Accomplishments in Sci., 1970 1972 p 98-102 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23345*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PERIODIC MOTIONS IN THE PROBLEMS OF THREE BODIES
Lloyd Carpenter *In its* Significant Accomplishments in Sci., 1970 1972 p 107-111 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03C

N72-23346*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY COSMIC DUST FLUX
Otto Berg *In its* Significant Accomplishments in Sci., 1970 1972 p 112-117 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23347*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GEGENSCHEIN AND DISTRIBUTION OF INTERPLANETARY DUST
Robert Roosen *In its* Significant Accomplishments in Sci., 1970 1972 p 118-124 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23348*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PHOTOCHEMISTRY AND LIFETIMES OF INTERSTELLAR MOLECULES
Louis Stief *In its* Significant Accomplishments in Sci., 1970 1972 p 125-128 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23349*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPLANETARY SHOCK NORMALS
Ronald Lepping *In its* Significant Accomplishments in Sci., 1970 1972 p 129-133 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23354*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISCOVERY OF A HECTOMETRIC SOLAR CONTINUUM
Harriet Malitson *In its* Significant Accomplishments in Sci., 1970 1972 p 154-158 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23358*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYDROGEN/HELIUM RATIO IN STARS
David Leckrone *In its* Significant Accomplishments in Sci., 1970 1972 p 176-181 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23359*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ABSOLUTE ULTRAVIOLET STELLAR FLUXES
Dennis Evans *In its* Significant Accomplishments in Sci., 1970 1972 p 182-189 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23360*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GUM NEBULA
John Brandt *In its* Significant Accomplishments in Sci., 1970 1972 p 190-195 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03A

N72-23361*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRAL CLASSIFICATION OF X-RAY SOURCES
Peter Serlemitsos *In its* Significant Accomplishments in Sci., 1970 1972 p 196-199 (See N72-23324 14-30)
Avail: NTIS HC $3.00 CSCL 03B

N72-23362*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRAL STRUCTURE OF THE DIFFUSE X-RAY SKY
Elihu Boldt *In its* Significant Accomplishments in Sci., 1970 1972 p 200-203 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23363*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GAMMA-RAY FLUXES
Donald Kniffen *In its* Significant Accomplishments in Sci., 1970 1972 p 204-208 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23364*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THEORETICAL IMPLICATIONS OF GAMMA-RAY ASTRONOMY
Floyd Stecker *In its* Significant Accomplishments in Sci., 1970 1972 p 209-211 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03A

N72-23366*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERSTELLAR ELECTRON INTENSITY
Reuven Ramaty *In its* Significant Accomplishments in Sci., 1970 1972 p 217-221 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23367*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENERGY LOSS OF COSMIC RAYS IN THE INTERPLANETARY
Lennard Fisk *In its* Significant Accomplishments in Sci., 1970 1972 p 222-226 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23368*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXTRAGALACTIC RADIO SPECTRUM
Larry Brown *In its* Significant Accomplishments in Sci., 1970 1972 p 227-230 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23369*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A 100-MICROMETER (100-MICRON)MAP OF THE GALACTIC CENTER
William Hoffman *In its* Significant Accomplishments in Sci., 1970 1972 p 231-237 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03B

N72-23370*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VERY LONG BASELINE INTERFEROMETRY
Thomas Clark *In its* Significant Accomplishments in Sci., 1970 1972 p 238-247 (See N72-23324 14-13)
Avail: NTIS HC $3.00 CSCL 03A

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N72-23903*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
THERMAL PROFILES OF THE DELTA SPACECRAFT FAIRINGS: HEOS-A2 THERMAL PROFILE, VOLUME 7
L. W. Gale 22 Sep. 1971 60 p ref
(Contract NAS7-764)
(NASA-CR-126530; MDAC-SM-42997-Vol-7) Avail: NTIS HC $5.00 CSCL 22B

The HEOS-A2 mission will utilize the DSV-3L launch vehicle. A profile of the DSV-3E-7 fairing, showing several points of analysis, is presented. The predicted inner wall temperature histories of the HEOS-A2 fairing are based on a depressed trajectory and the corresponding angle of attack history. Author

N72-23904*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION PRELIMINARY SYSTEM DESIGN. VOLUME 5: CONFIGURATION ANALYSES
A. J. Stefan and G. J. Goble Jan. 1972 414 p refs
(Contract NAS9-9953)
(NASA-CR-115410; SD-71-217-5-Vol-5) Avail: NTIS HC $22.75 CSCL 22B

The initial and growth modular space station configurations are described, and the evolutionary steps arriving at the final configuration are outlined. Supporting tradeoff studies and analyses such as stress, radiation dosage, and micrometeoroid and thermal protection are included. Author

N72-23905*# Chrysler Corp., New Orleans, La. Space Div.
HEAT TRANSFER RATE DISTRIBUTION ON NORTH AMERICAN ROCKWELL DELTA WING ORBITER DETERMINED BY PHASE CHANGE PAINT TECHNIQUE AT A MACH NUMBER OF 8, VOLUME 1 SADSAC/Space Shuttle Wind Tunnel Test Data Report
R. K. Matthews (ARO, Inc.), W. R. Martindale (ARO, Inc.), and J. D. Warmbrod (NASA. Marshall Space Flight Center) Mar. 1972 378 p
(Contract NAS8-4016)
(NASA-CR-120048; DMS-DR-1231-Vol-1; NASA-Ser-H-1028) Avail: NTIS HC $21.00 CSCL 22B

The results of a wind tunnel test program to determine aerodynamic heat transfer distributions on an orbiter configuration are presented. Heat-transfer rates were determined by the phase change paint technique on 0.013-scale Stycast models using Tempilaq as the surface temperature indicator. The nominal test conditions were; Mach 8, length Reynolds numbers of 6.0 x 1 million and 8.9 x 1 million, and angles of attack from 10 to 50 deg in 10-deg increments. At the higher Reynolds number, data were obtained with and without boundary layer trips. Model details, test conditions, and reduced heat-transfer data are presented. Data reduction of the phase-change paint photographs was performed by utilizing a new technique which is described in the data presentation section. Author

N72-23906*# Chrysler Corp., New Orleans, La.
AERODYNAMIC STABILITY AND DRAG CHARACTERISTICS OF A PARALLEL BURN/SRM ASCENT CONFIGURATION (M EQUALS 0.6 TO 4.96)
Frank Sims Apr. 1972 417 p
(Contract NAS8-4016)
(NASA-CR-120055; DMS-DR-1251) Avail: NTIS HC $22.75 CSCL 22B

Experimental aerodynamic investigations were conducted in the NASA/MSFC 14-inch trisonic wind tunnel during April 1972 on a 0.004-scale model of a solid rocket motor version of the space shuttle ascent configuration. The configuration consisted of a parallel burn solid rocket motor booster on an external HO centerline tank orbiter. Six component aerodynamic force and moment data were recorded over an angle of attack range from -10 deg to +10 deg at zero degrees sideslip and over a sideslip range from -10 deg to +10 deg at zero degrees angle of attack. Mach numbers ranged from 0.6 to 4.96. The purpose of the test was to determine the performance and stability characteristics of the complete ascent configuration and buildup, and to determine the effects of variations in HO tank and SRM nose shaping, orbiter incidence and position, and position of the solid rocket motors. Author

N72-23907*# Chrysler Corp., New Orleans, La. Space Div.
HEAT TRANSFER RATE DISTRIBUTIONS ON MCDONNELL-DOUGLAS BOOSTER DETERMINED BY PHASE CHANGE TECHNIQUE FOR NOMINAL MACH NUMBER OF 8
R. K. Matthews, W. R. Martindale, and J. D. Warmbrod Apr. 1972 186 p ref
(Contract NAS8-4016)
(NASA-CR-120043; DMS-DR-1207-Vol-2) Avail: NTIS HC $11.50 CSCL 22B

The results of a wind tunnel test program to determine aerodynamic heat transfer distributions on the McDonnell Douglas Booster configuration are presented. Heat-transfer rates were determined by the phase-change paint technique on 0.009-scale Stycast models using Tempilaq as the surface temperature indicator. The nominal test conditions were; Mach 8, length Reynolds numbers 5 million and 7.3 million, and angles of attack of 40, 50, and 60 deg. At the higher Reynolds number, data were obtained with and without boundary layer trips. Model details, test conditions, and reduced heat-transfer data are presented. Data reduction of the phase-change paint photographs was performed by utilizing a new technique which is described. Author

N72-23908*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE AND PLANETARY ENVIRONMENT CRITERIA GUIDELINES FOR USE IN SPACE VEHICLE DEVELOPMENT, 1971 REVISION
Robert E. Smith, ed. 15 Nov. 1971 372 p refs
(NASA-TM-X-64627) Avail: NTIS HC $20.75 CSCL 22B

A consolidation of natural environment data is presented for use as design criteria guidelines in space and planetary exploration vehicle development programs. In addition to information in the disciplinary areas of aeronomy, radiation, geomagnetism, astrodynamic constants, and meteoroids for the earth's environment above 90 kilometers, interplanetary space, and the planetary environments, the upper atmosphere model currently recommended for use at MSFC is discussed in detail. Author

N72-23909*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SSA-A SPACECRAFT MAGNETIC TESTS
Thomas N. Roy Oct. 1971 32 p refs
(NASA-TM-X-65875; X-325-72-72) Avail: NTIS HC $3.75 CSCL 22B

In the initial magnetic tests the spacecraft perm moment as received was 43 milliampere-meter squared (pole-cm), which was reduced by deperm treatment to milliampere-meter squared. Facility fluxgate probe bias results indicated Z axis bias at the SSS-A fluxgate magnetometer position to be about one half nanotesla (gamma) after Z axis deperm. The ASCS magnetometers, 01 and 02, were successfully aligned and proper operation of the ASCS system were verified. The spacecraft fluxgate magnetometer was calibrated in both the high and low sensitivity modes after a defective 01 electronics card was replaced.

Problems were encountered in the Z axis search coil during calibration and the test was re-scheduled. Final test results indicated that the total perm moment could not be reduced any lower than 35 milliampere-meter squared by deperm treatment. However, the Z axis moment decreased from 22 milliampere-meter squared to 6 milliampere-meter squared after deperm. Correct operation and calibration was verified for all three axes of the spacecraft fluxgate magnetometer and no significant bias was observed during stray field testing. Null and spot calibration of the ASCS magnetometer was completed and the measured spin and attitude coil moments were: 2535 and 9820 milliampere-meter squared respectively. Author

N72-23910*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
IMP SERIES REPORT/BIBLIOGRAPHY
Joseph H. King Dec. 1971 248 p refs
(NSSDC-71-21; NASA-TM-X-67781) Avail: NTIS HC $14.50 CSCL 22A

The main characteristics of the IMP spacecraft are summarized. Experiments from a scientific rather than technological point of view are discussed. The scientific knowledge gained from this series of spacecraft in the form of abstracts of scientific papers using IMP data is presented. Spacecraft characteristics, including temporal and spatial coverages, are presented and are followed by a bibliography containing abstracts from spacecraft-related papers. Experiments on all IMPs (including prelaunch IMPs -H and -J) are described. Figures are presented showing the time histories, through the end of 1970, of magnetic field, plasma, and energetic particles experiments. A bibliography containing abstracts is presented for each experiment on each spacecraft from IMP A through IMP G. Wherever possible, the abstracts for spacecraft- and experiment-related papers are by the originating authors. Author

N72-23911*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE: STATIC AERODYNAMIC CHARACTERISTICS AND CONTROL EFFECTIVENESS OF TWO DELTA WING ORBITER CONFIGURATIONS (M EQUALS 0.6 TO 4.96)
Roger R. Ellis, R. E. Buchholz, and J. A. Moore Mar. 1972 853 p
(Contract NAS8-4016)
(NASA-CR-120020; DMS-DR-1201; NASA-Ser-S-1026.10) Avail: NTIS HC $44.75 CSCL 22B

Two 0.00325-scale models of a space shuttle orbiter were tested in trisonic wind tunnel to obtain force, static stability, and control effectiveness data by six component internal strain gauge balance. Two separate configurations were tested; however, the fuselage and basic wing were of one-piece construction. The configurations were varied by replacing the straight wing tip extensions with upswept wing tips. Directional stability was provided for one configuration by a centerline vertical tail. Due to the one-piece body/wing construction, no body-alone data were obtained. The effect of tip fins and vertical tail size were, however, investigated. Both configurations were tested over a Mach range of 0.6 to 4.96 with data taken at angles of attack from minus 4 deg to 60 deg and at angles of sideslip from minus 4 deg to 10 deg. Author

N72-23912*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACE SHUTTLE GUIDANCE, NAVIGATION AND CONTROL DESIGN EQUATIONS. VOLUME 4: DEORBIT AND ATMOSPHERIC OPERATIONS
K. J. Cox 1 Dec. 1971 94 p refs Revised Supersedes MSC-04217-Rev-A
(Proj. Space Shuttle)
(NASA-TM-X-67709; MSC-04217-Rev-B-Vol-4) Avail: NTIS HC $6.75 CSCL 17G

A baseline set of equations which fulfill the computation requirements for guidance, navigation, and control of the space shuttle orbiter vehicle is presented. All shuttle mission phases are covered from prelaunch through landing/rollout. The spacecraft flight mode and the aircraft flight mode are addressed. The baseline equations may be implemented in a single guidance, navigation, and control computer or may be distributed among several subsystem computers. Author

N72-23913*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SELF-CONTAMINATION AND ENVIRONMENT OF AN ORBITING SPACECRAFT
John J. Scialdone Washington May 1972 35 p refs
(NASA-TN-D-6645; G-1036) Avail: NTIS HC $3.00 CSCL 22B

The flux of molecules emitted by a spacecraft and subsequently reflected to its surface was investigated. The reflection occurs upon collision of the outgassed molecules with ambient molecules. Evaluation of the flux was based on a knowledge of the spacecraft outgassing rate, the spacecraft dimensions, and the orbit parameters. Condensation rates and adsorption layers on critical surfaces were calculated from the knowledge of this flux and the nature and temperature of the gas and the surface. Based on estimated and measured emission rates, calculation of these parameters was performed for a number of spacecraft. The relationships and graphs developed allow an estimate of several important parameters for an orbiting spacecraft to be made. The pressures and densities at various distances from the spacecraft, as produced by the surrounding ambient molecules and by the spacecraft's own outgassing, are presented. The pressure and density produced by the outgassing can be obtained as a function of time if the behavior of the outgassing with time is known. The number of desorbed molecules ionized by impact with ambient charged particles and the effect of the spacecraft's electric field on polarized desorbed molecules were considered. Author

N72-23914*# Systems Technology, Inc., Hawthorne, Calif.
HANDLING QUALITIES CRITERIA FOR THE SPACE SHUTTLE ORBITER DURING THE TERMINAL PHASE OF FLIGHT
Robert L. Stapleford, Richard H. Klein, and Roger H. Hoh Washington NASA Apr. 1972 150 p refs
(Contract NAS2-6075)
(NASA-CR-2017) Avail: NTIS HC $3.00 CSCL 22C

It was found that large portions of the military handling qualities specification are directly applicable. However a number of additional and substitute criteria are recommended for areas not covered or inadequately covered in the military specification. Supporting pilot/vehicle analyses and simulation experiments were conducted and are described. Results are also presented of analytical and simulator evaluations of three specific interim Orbiter designs which provided a test of the proposed handling qualities criteria. The correlations between the analytical and experimental evaluations were generally excellent. Author

N72-23915# European Space Vehicle Launcher Development Organization, Paris (France).
PREPARATORY WORK FOR A POSSIBLE EUROPEAN COLLABORATION IN THE POST-APOLLO PROGRAM: ELDO TECHNOLOGY PROGRAM 1971 FOR THE LAUNCH VEHICLE STRUCTURE [VORBEREITUNG EINER EVENTUELLEN MITARBEIT EUROPAS AM APOLLO-NACHFOLGE-PROGRAMM: ELDO TECHNOLOGIE-PROGRAMM FUER DIE STRUKTUR DES RAUMTRANSPORTERS]
Richard J. Jonke Oct. 1971 24 p In GERMAN Presented at the 4th DGLR Annual Meeting, Baden-Baden, West Ger., 11-13 Oct. 1971
(ELDO-29; DGLR-Paper-71-002) Avail: NTIS HC $3.25

Preliminary work on studies of spacecraft structures and materials as part of the possible European participation in the post-Apollo Program is reviewed. The development of structural materials suitable for the Orbiter stage of the space shuttle is discussed with the emphasis on carbon fiber reinforced resin bonded composite materials. Heat shielding materials and thermal fatigue are also considered. Author (ESRO)

N72-23916# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany). Space Div.
CONTROL AND STABILIZATION ASPECTS OF AN ADVANCED TELECOMMUNICATIONS SATELLITE WITH FLEXIBLE ANTENNAS AND SOLAR ARRAYS
K. Fetzer, R. Habek, R. Leo, F. Pfeiffer, A. Pohl, E. Roelleke, J. Santana, H. Schweig, and H. Weingarten Paris ESRO Sep. 1971 419 p refs Prepared for ESRO
(Contract ESTEC-1230-71)
(ESRO-CR-55) Avail: NTIS HC $23.00

A satellite configuration trade-off, flexible satellite dynamics, and an attitude control system design are studied. Three configurations are studied, and a flywheel-stabilized configuration with solar arrays mounted north-south is found to be most favorable. In the dynamic analysis of the roll-out solar array, small elastic displacements and transverse vibrations are considered. The corresponding equations of motion, the array eigenfrequencies, the torques exerted on the satellite body, and the integrals necessary for simulation of the complete satellite system are derived. The array model is coupled to a simple model of the satellite, so that the stability of the system and the effect of parameter variations can be studied. The design of an attitude control system is considered for a rigid satellite, and for a flexible configuration. A system based on a double-gimballed flywheel is found to be optimum for roll-yaw control since the momentum requirement is lower and the time between reorientation maneuvers is greater. Author (ESRO)

N72-23917# RAND Corp., Santa Monica, Calif.
THE COMMUNICATION SATELLITE: A PERSPECTIVE FOR THE 1970'S
Nathaniel E. Feldman and Charles M. Kelly (Aerospace Corp.) Sep. 1971 10 p
(AD-737232; P-4658) Avail: NTIS CSCL 22/2

While editing two books on communication satellites for the MIT Press, it seemed necessary to try to set the 74 papers on technology and systems in these two volumes into the context of the 'communications revolution'. The preface to the two books therefore attempted to relate communication satellite programs to current research and development programs in digital data networks, videophones, cable television distribution systems, video cassette and home playback equipment, and millimeter waveguide and laser links. That brief preface was expanded to this paper. GRA

N72-23802*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 14 FLIGHT SUPPORT AND SYSTEM PERFORMANCE
Robert R. Rice *In its* MSC Cryog. Symp. Papers May 1971 p 488-509 (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 22B

N72-23286*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
MANNED SYSTEMS FOR SENSING EARTH'S RESOURCES
John E. Dornbach *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1972 35 p Original contains color illustrations (See N72-23280 14-13)
(NASA-TM-X-67711) Avail: NTIS HC $3.75 CSCL 14B

N72-23287*# National Aeronautics and Space Administration, Washington, D.C.
UNMANNED SPACECRAFT FOR SURVEYING EARTH'S RESOURCES
Theodore A. George *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 12 p (See N72-23280 14-13)
(NASA-TM-X-67712) Avail: NTIS HC $3.00 CSCL 22B

N72-23290 Committee on Science and Astronautics (U. S. House).
AN EARTH RESOURCES SATELLITE SYSTEM IN A POLITICAL LIGHT
Joseph E. Karth *In* Princeton Univ. Proc. of the Princeton Univ. Conf. on Aerospace Methods for Revealing and Evaluating Earth's Resources Jun. 1970 10 p refs (See N72-23280 14-13)
Copyright. Avail: Issuing Activity

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N72-23918*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DESIGN CONSIDERATIONS FOR FIBER COMPOSITE STRUCTURES
C. C. Chamis 1972 33 p refs Presented at Natl. Meeting on Structural Eng., Cleveland, 24-28 Apr. 1972; sponsored by Am. Soc. of Civil Engr.
(NASA-TM-X-68039; E-6813) Avail: NTIS HC $3.75 CSCL 20K

An overview of the design methodology for designing structural components from fiber composites is presented. In particular, the need for new conceptual structural designs for the future is discussed and the evolution of conceptual design is illustrated. Sources of design data, analysis and design procedures, and the basic components of structural fiber composites are cited and described. Examples of tradeoff studies and optimum designs are discussed and a simple structure is described in some detail. Author

N72-23919*# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
NONLINEAR BEHAVIOR OF SHELLS OF REVOLUTION UNDER CYCLIC LOADING
Howard S. Levine, Harry Armen, Jr., Robert Winter, and Allan Pifko Apr. 1972 79 p refs Presented at Natl. Symp. on Computerized Structural Analysis and Design, Washington, D.C., 27-29 Mar. 1972
(Contract NAS1-10087)
(NASA-CR-126389; RE-426J) Avail: NTIS HC $6.00 CSCL 20K

A large deflection elastic-plastic analysis is presented, applicable to orthotropic axisymmetric plates and shells of revolution subjected to monotonic and cyclic loading conditions. The analysis is based on the finite-element method. It employs a new higher order, fully compatible, doubly curved orthotropic shell-of-revolution element using cubic Hermitian expansions for both meridional and normal displacements. Both perfectly plastic and strain hardening behavior are considered. Strain hardening is incorporated through use of the Prager-Ziegler kinematic hardening theory, which predicts an ideal Bauschinger effect. Numerous sample problems involving monotonic and cyclic loading conditions are analyzed. The monotonic results are compared with other theoretical solutions. Author

N72-23920# Joint Publications Research Service, Arlington, Va.
DETERMINATION OF ENDURANCE MARGINS
P. Ye. Kravchenko 25 Apr. 1972 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Mashinostr. (Moscow), no. 10, 1971 p 30-33
(JPRS-55792) Avail: NTIS HC $3.00

Deficiencies and errors accepted in the determination of endurance margins are examined. Recommendations are made

on the elimination of indicated deficiencies. The magnitudes of design coefficients and other mechanical characteristic features the absence of which would not permit performing concrete endurance computations are presented. Author

N72-23921*# Syracuse Univ., N.Y.
ANALYSIS OF FATIGUE CRACK PROPAGATION
H. W. Liu Washington NASA May 1972 42 p refs
(Grant NGR-33-022-105)
(NASA-CR-2032) Avail: NTIS HC $3.00 CSCL 20K

The correlation between fatigue crack propagation and stress intensity factor is analyzed. When determining fatigue crack propagation rate, a crack increment, delta a, and its corresponding increment in load cycles, delta N, are measured. Fatigue crack propagation must be caused by a shear and/or a normal separation mode. Both of these two processes are discrete if one looks at the atomic level. If the average deformation and fracture properties over the crack increments, delta a, can be considered as homogeneous, if the characteristic discrete lengths of sigma a, if the plastic zone size is small, and if a plate is thick enough to insure a plane strain case, da/dN is proportional to delta K squared. Any deviation of empirical data from this relation must be caused by the fact that one or more of these conditions are not satisfied. The effects of plate thickness and material inhomogeneity are discussed in detail. A shear separation mode of fatigue crack propagation is described and is used to illustrate the effects of material inhomogeneity. Author

N72-23922# Lockheed Missiles and Space Co., Palo Alto, Calif.
DYNAMIC STABILITY OF CYLINDRICAL SHELLS UNDER RAPID HEATING
A. S. Volmir and A. T. Ponomarev 1972 6 p refs Transl. into ENGLISH from Prikl. Mekh., v. 8, no. 1, 1972 p 3-9
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Stability of large closed cylindrical shells, hinge-fastened with supports not displaceable in the longitudinal direction and nonuniformly heated over the thickness, were investigated. For sufficiently intense changes in temperature, the compressive stresses originating in the structure can exceed the magnitudes of both the lower and upper critical loadings. The inertial forces corresponding to the deflection must be taken into account in the fundamental equations and the time history of the shell must be considered. Points on the shell endfaces were considered to move freely in the radial direction. Author

N72-23923# Lockheed Missiles and Space Co., Palo Alto, Calif.
CONSTRUCTION OF A SYSTEM OF HARMONIC FUNCTIONS TO COMPUTE THE AXISYMMETRIC OSCILLATIONS OF A FLUID IN AN ELASTIC CYLINDRICAL TANK WITH SPHERICAL BASE
A. A. Pozahalostin 1972 3 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. Tverdogo Tela, no. 1, 1972 p 132-134
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The system of harmonic functions developed permits satisfying the condition on the free surface of the fluid by neglecting its wave oscillations, and determining the pressure on the shell surface in the same functions as those used to solve the equations for the shell. Author

N72-23924# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE THEORY OF ELASTIC STABILITY OF A CYLINDRICAL SHELL WEAKENED BY A CIRCULAR HOLE
Iu. A. Ashmarin 1972 7 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 8, no. 1, 1972 p 27-34
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The fundamental equations of the theory of elastic stability of a cylindrical shell weakened by a relatively large circular hole are developed. Presented are nonlinear equations of a cylindrical shell referred to a polar semi-geodesic coordinate system, wherein rotations, elongations and shear are taken into account in the derivation. In connection with the question of stability of a shell weakened by a relatively large circular hole, the equilibrium equations are linearized with respect to additional displacements. A nonlinear dependence of the tangential strains on the displacements is assumed. Author

N72-23925# California Univ., Livermore. Lawrence Radiation Lab.
TIME-DEPENDENT STRESS RUPTURE IN MECHANICAL SYSTEMS
Karl S. Pister 12 Oct. 1971 16 p refs
(Contract W-7405-eng-48)
(UCRL-51123) Avail: NTIS

The problem of estimating the reliability of a mechanical system and expressing a confidence in that estimate when the system is subject to failure by stress rupture are discussed. The necessary assumptions, along with the mathematical physics and statistics that are required to construct models of such systems, are noted. Typical models and illustrations of their applications are described. For systems that are designed to operate for long times with a high reliability and confidence, the difficulties in setting up sampling programs are noted. Some preliminary data from tests on S-glass strands and pressurized thinwalled spheres are discussed in the appendix. Author

N72-23926# California Univ., Livermore. Lawrence Radiation Lab.
ANALYSIS OF STRESS-RUPTURE DATA FROM S-GLASS COMPOSITES
E. Y. Robinson (Rohr Corp., San Diego, Calif.) and T. T. Chiao 19 Aug. 1971 33 p refs Presented at 27th Reinforced Plastics Tech. and Management Conf., Washington, D. C., 8-11 Feb. 1972 Submitted for publication Sponsored by AEC
(UCRL-73358; Conf-720201-1) Avail: NTIS

A substantial amount of stress-rupture data on S-glass multifilament yarn has been accumulated. Both composite and free strands have been tested to study matrix effectiveness. Glass from different lots were used, and processing parameters were also varied to demonstrate the effects of material variability. In several cases the static loads were terminated after long test times to study the path of strength retention. Large sample sizes were used (frequently 100 specimens). The statistical behavior of the data was analyzed and rationale are provided for classifying and interpreting the observed distributions. The statistical patterns that emerge from these experiments showed that lifetime distributions are characteristically skewed. As a class, the lifetime distributions are well approximated by the reduced form of the Weibull distribution. The normalized form of this distribution was used as a convenient analytical tool to represent these lifetime distributions. Author

N72-23927# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
PLASTIC FATIGUE MODEL WITH TRACTION-COMPRESSION LOADING Ph.D. Thesis - Paris Univ., Orsay, 1970 [MODELE PLASTIQUE DE FATIGUE EN CHARGEMENT DE TRACTION-COMPRESSION]
Jean-Marie Noppe 1971 43 p refs In FRENCH; ENGLISH summary
(ONERA-NT-178) Avail: NTIS HC $4.25

In order to describe the fatigue behavior of metallic materials two parameters statistically distributed within the structure are proposed. The stress, the first parameter, is assumed to be distributed on a coarser scale than the damage, the second parameter. Variations of the characteristics of these two distributions are determined as a function of the applied loads and with the help of the plastic deformation curve. The rupture point is precisely obtained in the elastoplastic range. The validity of the proposed laws was assessed against a number of experimental results. Author (ESRO)

N72-23928# Army Materials and Mechanics Research Center, Watertown, Mass. Structural Mechanics Div.
DYNAMIC RESPONSE OF MODERATELY THICK CIRCULAR CYLINDRICAL PANELS
Tien Y. Tsui Sep. 1971 22 p refs
(DA Proj. 1T062105-A-349)
(AD-736328; AMMRC-TR-71-40) Avail: NTIS

A numerical procedure is presented for the solution of the dynamic response of a moderately thick circular cylindrical panel within the framework of the improved shell theory which includes effects of transverse shear and rotatory inertia. Application was made to determine the transient response of panels to a time-varying normal load uniformly distributed over the entire panel surface. The results were compared with the findings based on the classical shell theory. Noteworthy differences between the two theories were observed. The effect of the edge constraints on the dynamic behavior of the panel was also examined. Author

N72-23929# Washington Univ., Seattle. Dept. of Civil Engineering.
DETERMINATION OF MOTION AND DEFLECTION OF RETAINING WALLS. PART 2: TECHNICAL APPLICATIONS Final Technical Report
S. A. Veress and G. E. DeGross 1 Apr. 1971 105 p refs
Sponsored in part by Wash. State Highway Comm.
(DOT-FH-Agreement-Y-1155)
(PB-205027) Avail: NTIS HC $3.00 CSCL 13B

Terrestrial photogrammetry to determine the motion and deflection of retaining walls is discussed. A photogrammetric method which can be used to monitor the behavior of larger structures is developed. The study is divided into two parts; the first one is the theory of photogrammetric deformation. The second part of the research consists of practical experimentation and technical application. From this research it was concluded that the detection and monitoring of the deflection of retaining walls is possible and economically feasible by photogrammetric methods. Author (GRA)

N72-23930# Biot (Maurice A.), Brussels (Belgium).
THEORY OF FINITE DEFORMATIONS OF POROUS SOLIDS Interim Report
Maurice A. Biot Apr. 1971 48 p refs
(Contract F44620-71-C-0092; AF Proj. 9782)
(AD-736833; AFOSR-71-1918TR) Avail: NTIS CSCL 20/11

The theory of finite deformations of porous solids containing a viscous fluid is established. It is based on material coordinates, as in the classical finite elasticity theory. The case of non-Newtonian viscosity is included. Key concepts are, a generalized pressure function and a non-Cartesian vector representing the mass flow through a surface attached to the solid. These concepts are natural consequences of thermodynamic considerations. The theory is applicable to materials with anisotropic and inhomogeneous porosity. Equilibrium fields and basic stress-strain relations are derived in several alternate forms using contact transformations. Darcy's law is established in its most general form and the dissipation function on which it is based, is derived and discussed for anisotropic solids and non-Newtonian fluids. GRA

N72-23931# New Mexico Univ., Albuquerque. Dept. of Mechanical Engineering.
ON WAVE PROPAGATION IN TRUNCATED CONICAL SHELLS. VOLUME 2: ELASTIC WAVES GENERATED BY OBLIQUE IMPACT Technical Report, Dec. 1968 - Jul. 1971
B. Albrecht, W. E. Baker, and M. Valathur Dec. 1971 79 p refs
(Contract F29601-69-C-0023; AF Proj. 5791)
(AD-737101; AFWL-TR-71-103-Vol-2) Avail: NTIS CSCL 19/1

Strain waves in a truncated conical shell generated by oblique impact of the small end of the shell are discussed. The analysis is based on the general first-order linear shell theory of Sanders with all pertinent variables expanded into Fourier series in circumferential direction, resulting in decoupled sets of ordinary differential equations. Finite-difference approximations to these differential equations are then solved by matrix techniques. Author (GRA)

N72-23932# Iowa Univ., Iowa City. Dept. of Mechanics and Hydraulics.
THE ENDOCHRONIC THEORY OF VISCOPLASTICITY: APPLICATION TO THE MECHANICAL BEHAVIOR OF METALS Final Report
Kirk C. Valanis Dec. 1971 138 p refs Prepared in cooperation with Stevens Inst. of Tech.
(Contract AF-AFOSR-1916-70; AF Proj. 9749)
(AD-736781; AFOSR-72-0316TR) Avail: NTIS CSCL 20/11

A theory of thermoviscoplasticity is developed, which is firmly founded on the principles of irreversible thermodynamics of internal variables developed previously by the author. It differs from previous theories in the essential axiom that the material senses changes in deformation and temperature in a time scale which is an inherent material property. The theory has thus been termed ENDOCHRONIC. Material behavior is described in terms of heredity functions akin to those in viscoelasticity. Many applications to the mechanical behavior of copper and aluminum are then considered, and many facets of their behavior such as yield, hysteresis, Bauschinger effect, cross-hardening, cyclic hardening, creep and relaxation are predicted and described analytically by the theory, with remarkable accuracy. Author (GRA)

N72-23933# Naval Research Lab., Washington, D.C.
DETERMINATION OF FIXED BASE NATURAL FREQUENCIES OF A COMPOSITE STRUCTURE OR SUBSTRUCTURES: EXPERIMENT AND APPLICATION Interim Report
Ni Chen-Chou and James P. Layher 30 Dec. 1971 21 p refs
(AD-737193; NRL-7362) Avail: NTIS CSCL 13/13

A generalized method, reported in NRL report 7300, for determining the fixed-base natural frequencies of an in situ or laboratory mechanical structure or substructure is tested by experiments. The test structure was composed of a simple steel beam on three supports which were mounted on flexible members of a trusslike frame. THe fixed-base natural frequencies of the lowest two modes of the test beam were determined by the aforementioned semianalytical method. Theoretical calculations and a standard resonance test were also performed for comparison. Results confirmed the applicability and usefulness of the developed method, as predicted by the theoretical analysis. Author (GRA)

N72-23934# Aerospace Corp., San Bernardino, Calif.
ASAAS: ASYMMETRIC STRESS ANALYSIS OF AXISYMMETRIC SOLIDS WITH ORTHOTROPIC, TEMPERATURE-DEPENDENT MATERIAL PROPERTIES THAT CAN VARY CIRCUMFERENTIALLY
James G. Crose 29 Dec. 1971 283 p refs
(Contract F04701-71-C-0172)
(AD-737357; TR-0172(S2816-15)-1; SAMSO-TR-71-297) Avail: NTIS CSCL 20/11

The finite element method for the determination of stresses and displacements in arbitrary axisymmetric solids is extended to problems involving asymmetric mechanical and thermal loads and materials with asymmetric temperature-dependent mechanical properties. All dependent variables, including the mechanical properties, are represented by a Fourier series expansion of the circumferential coordinate. Due to the mechanical property variation in the circumferential direction, the resulting equation set becomes fully coupled and must be solved simultaneously. By grouping all Fourier coefficients together at each nodal point, a banded stiffness matrix is achieved for which an efficient solution is feasible by the use of a blocked square root Cholesky method. A user-oriented computer program based on the method of analysis is described and applied to several example problems to verify accuracy and demonstrate the versatility of the program. Author (GRA)

N72-23935# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ISO-DAMAGE CURVES FOR A SIMPLY SUPPORTED BEAM M.S. Thesis
Willaim E. Danner Dec. 1971 59 p refs
(AD-737362; GAW/MC/72-5) Avail: NTIS CSCL 13/13

The paper presents a theoretical development of iso-damage curves for elastic-perfectly plastic simply supported beams which are loaded by blast waves. A blast wave is modeled as a simple exponentially decaying forcing function. The development assumes the beam responds in its normal modes of vibration during the elastic phase of the response and as a mechanism after the elastic limit is reached. The use of iso-damage curves is illustrated. Theoretical predictions of plastic deformation of a simply supported beam computed using the first mode approximation and those computed using the first and the third mode approximation bracket the experimental data of Baker.
Author (GRA)

N72-23936# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RATE OF FATIGUE CRACK PROPAGATION IN THE AIRFRAME STRUCTURE
Witold Blazewicz 18 Nov. 1971 15 p refs Transl. into ENGLISH from Tech. Lotnicza i Astronautyczna (Poland), v. 25, no. 2, 1970 p 10-13, 20
(AD-736887; FTD-HC-23-1487-71) Avail: NTIS CSCL 01/3

A description is given of a method for calculating the fatigue strength of airframe structures with an existing crack. The method makes it possible to determine the dependence of crack length on the duration of usage (number of kilometers covered in flight or the number of flight hours). The technique was used to study fatigue strength in samples with and without strain hardening, showing the influence of strain hardening on crack propagation parameters during variable amplitude loading (based on load spectra for transport aircraft). The test data show the possibility of a significant reduction on the rate of crack propagation with the aid of properly chosen strain hardening.
Author (GRA)

N72-23937# Notre Dame Univ., Ind. Coll. of Engineering.
PROBABILISTIC BUCKLING BEHAVIORS OF STRUCTURES WITH RANDOM LACK OF FIT
Cary K. Mak and Sydney Kelsey Jan. 1972 27 p refs
(Contract N00014-68-A-0152; NR Proj. 260-112)
(AD-736967; UND-72-1) Avail: NTIS CSCL 13/13

The probabilistic buckling behavior of structures due to externally applied loads and initial internal forces caused by random lack-of-fit of members is treated as a random eigenvalue problem. For some structures, the critical buckling load can be related explicitly in terms of the random lack-of-fit parameter of the problem. Thus, if the probability distribution of the lack-of-fit of members is known, the probability of critical buckling of the structure can be evaluated exactly.
Author (GRA)

N72-23938# Finnish Academy of Technical Sciences, Helsinki.
A FRAMEWORK METHOD FOR STRETCHED PLATES
Eero-Matti Salonen 1971 26 p refs
(PB-206026; APS-CI-69) Avail: NTIS HC $3.00; ACTA Polytechnica Scandinavica Publishing Office, Box 5073, Stockholm: Sw. kr. 10.00 CSCL 13M

A physical triangular plane stress finite element is derived, composed of three bars situated along the sides of the element. The bars have suitable values of extensional and bending stiffnesses, and are rigidly connected to each other at the three nodes of the element. The displacement parameters at the nodes are the two translational components and the mean rotation of the plate. The element is generally valid only when Poisson's ratio is zero. By the merging of elements of these kinds, a substitute structure is obtained for a stretched plate which can be analysed by a standard plane framework program. The suitable properties of the bars of the element are found by comparison of the strain energy of the element with that of the plate.
Author (GRA)

N72-23939# Naval Ship Research and Development Center, Bethesda, Md. Structures Dept.
STRESSES AROUND TWO REINFORCED OPENINGS OF GENERAL SHAPE
S. K. Dhir Jan. 1972 27 p refs
(AD-737252; NSRDC-3768) Avail: NTIS CSCL 20/11

A general method is presented for determining the stresses around two openings of any shape in a large plate of elastic isotropic material. The two openings can have individual boundary reinforcements. The method is based on the complex variable approach combined with the Schwarz successive approximation technique. As an illustration of the method, the stresses are computed for the case of a small circular opening near a large circular opening. The amounts of reinforcing material on these two openings were varied to determine the optimum reinforcement. Several cases which frequently occur in ship construction are included.
Author (GRA)

N72-23940# Wisconsin Univ., Madison. Mathematics Research Center.
BUCKLING OF A CIRCULAR PLATE RESTING ON AN ELASTIC FOUNDATION
H. Steinberg Jan. 1972 61 p refs
(Grant DA-31-124-ARO(D)-462)
(AD-737241; MRC-TSR-1063) Avail: NTIS CSCL 20/11

The Foppl and v. Karman nonlinear differential equations provide a mathematical description of the physical phenomena being studied. A variation of a perturbation procedure is used to obtain an approximate solution when the spring constant and normal loading are small and the compressive loading is in the neighborhood of a critical buckling load. The 'shooting' technique is used to continue the solutions numerically into regions of larger compressive loadings, normal loadings and spring constant.
Author (GRA)

N72-23941# Virginia Polytechnic Inst., Blacksburg. Coll. of Engineering.
SOME ORTHOTROPIC SHELLS OF REVOLUTION WITH BENDING SUPPRESSED Progress Report
S. V. Kulkarni, Richardo Chicurel, and Daniel Frederick 15 Dec. 1971 31 p refs Presented at the St. Louis Symp. on Advanced Composites (5th), 21-23 Apr. 1971
(Contract DAAF07-69-C-0444)
(AD-737316; VPI-E-71-28) Avail: NTIS CSCL 20/11

The underlying philosophy in the design of composite material structures is the optimum combination of a high strength material and a relatively low strength matrix to achieve an improved strength to weight ratio with cost as a criterion. Thus, the most efficient utilization of the unidirectional strength of the material is desired. In order that membrane theory can be applied with bending stresses completely suppressed, the shell configuration should be adjusted. In this paper, shell configurations are obtained for orthotropic toroidal type shells with axial load only and for orthotropic shells with axial load and internal pressure. An axisymmetric problem is considered with the axes of orthotropy coinciding with the meridional and circumferential directions. The effect of orthortopy on the Gaussian curvature of the shell is discussed. The relative importance of the axial load to the internal pressure ratio is also studied.
Author (GRA)

N72-23942# Lehigh Univ., Bethlehem, Pa. Fritz Engineering Lab.
STRENGTH FORMULAS FOR DESIGN OF STEEL PLATE GIRDERS
Alexis Stapenko, Chingmiin Chern, and Siamak Parsanejad Nov. 1971 53 p refs Sponsored by DOT, Am. Iron and Steel Inst. and the Pennsylvania Dept. of Transportation
(PB-206660; FEL-328.12) Avail: NTIS HC $3.00 CSCL 13M

Design formulas are presented for evaluating the ultimate strength of plate girder panels under bending, shear, or a combination of shear and bending. The formulas were evolved from a study of the numerical data obtained using the analytical

methods previously developed in the course of this research. The ultimate strength of a panel is obtained as a sum of the contributions by the web buckling strength (beam action), the web post buckling strength (tension field action), and the flange strength (frame action). A tentative recommendation is made for precluding the development of fatigue cracks due to the back-and-forth deflection of the web plate. GRA

N72-23943# Army Foreign Science and Technology Center, Charlottesville, Va.
MAJOR PRESENT TRENDS IN MATHEMATICAL THEORY OF PLASTICITY
I. V. Knets 23 Feb. 1972 118 p refs Transl. into ENGLISH of the book "Osnoynye Sovremennye Napravleniya v Matematicheskoi Theorii Plastichnosti' Riga, Zinatne, 1971
(AD-737386; FSTC-HT-23-1072-72) Avail: NTIS CSCL 20/11

The book analyzes mathematical theories of plasticity that connect deformation and stress increases (flow theory), finite deformations and and stressed states (deformation theory), and stress and deformation tensors on the basis of statistical averaging (statistical theories). The various strengthening conditions, defining the character of change of the load surface during the process of plastic deformation, are described in detail. Four main types of strengthening are analyzed: isotropic, kinematic, combined, and the one connected with the formation of singular loading surfaces. A comparison between the various viscosity conditions, strengthening conditions, and plasticity theories on the basis of experimental data is conducted.
Author (GRA)

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N72-23944*# Cincinnati Univ., Ohio.
NOISE ANALYSIS OF NUCLEATE BOILING
R. D. McKnight and K. S. Ram [1971] 61 p refs
(Grant NGR-36-004-008)
(NASA-CR-126382) Avail: NTIS HC $5.25 CSCL 20M

The techniques of noise analysis have been utilized to investigate nucleate pool boiling. A simple experimental setup has been developed for obtaining the power spectrum of a nucleate boiling system. These techniques were first used to study single bubbles, and a method of relating the two-dimensional projected size and the local velocity of the bubbles to the auto-correlation functions is presented. This method is much less time consuming than conventional methods of measurement and has no probes to disturb the system. These techniques can be used to determine the contribution of evaporation to total heat flux in nucleate boiling. Also, these techniques can be used to investigate the effect of various parameters upon the frequency response of nucleate boiling. The predominant frequencies of the power spectrum correspond to the frequencies of bubble generation. The effects of heat input, degree of subcooling, and liquid surface tension upon the power spectra of a boiling system are presented. It was found that the degree of subcooling has a more pronounced effect upon bubble size than does heat flux. Also the effect of lowering surface tension can be sufficient to reduce the effect of the degree of subcooling upon the size of the bubbles. Author

N72-23945*# Pennsylvania State Univ., University Park. Dept. of Mechanical Engineering.
INVESTIGATION OF CRITICAL BURNING OF FUEL DROPLETS Annual Report, 1971
C. B. Allison, G. S. Canada, and G. M. Faeth Jan. 1972 34 p refs
(Grant NGR-39-009-077)
(NASA-CR-120879) Avail: NTIS HC $3.75 CSCL 21I

Measurements were made on the burning of liquid hydrazine, MMH, and UDMH in a combustion gas environment. The experimental range of these tests involved gas temperatures of 1660-2530 K, oxygen concentrations of 0-42% by mass and droplet diameters (employing both droplets and porous spheres) of 0.11-1.91 cm. at atmospheric pressure. A simplified hybrid combustion theory was developed which was found to correlate the present results as well as the experimental measurements of other investigators. Measurements were also made of the monopropellant strand burning rates and liquid surface temperatures of a number of nitrate ester fuels and hydrazine at elevated pressures. The temperature measurements for the nitrate esters were found to be in good agreement with a theoretical model which allowed for gas solubility in the liquid phase at high pressures. Experimental results were also obtained on the burning rates and liquid surface temperatures of a number of paraffin and alcohol fuels burning in air pressures up to 72 atm. For these tests, the fuels were burned from porous spheres in a natural convection environment. Initial findings on a pressurized flat flame burner are also described as well as the design of an oscillatory combustion apparatus to test the response of burning liquid fuels. Author

N72-23946*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE AEROTHERMODYNAMIC ENVIRONMENT OF THE APOLLO COMMAND MODULE DURING SUPERORBITAL ENTRY
Dorothy B. Lee and Winston D. Goodrich Washington Apr. 1972 87 p refs
(NASA-TN-D-6792; MSC-S-267) Avail: NTIS HC $3.00 CSCL 22C

Aerothermodynamic measurements were obtained on two Apollo spacecraft during atmospheric entry at near-lunar-return velocities. Histories of measured pressure and of convective and radiative heating rates are compared with theoretical predictions and with wind-tunnel results. The comparisons show that pressures measured in the wind tunnel correspond to those measured in the flight environment of the entry face. Unexplained low pressures were obtained on the conical section. Measured radiative heating rates agree with predictions calculated for both visible and infrared radiation. Good agreement was found between convective heating rates measured in flight and predictions obtained by using cold wall theory adjusted for mass injection from the ablator. Author

N72-23947*# General Applied Science Labs., Inc., Westbury, N.Y.
ANALYTICAL STUDY OF GRAVITY EFFECTS ON LAMINAR DIFFUSION FLAMES
R. B. Edelman, O. Fortune, and G. Weilerstein Feb. 1972 136 p refs
(Contract NAS3-14378)
(NASA-CR-120921; GASL-TR-771) Avail: NTIS HC $9.00 CSCL 20M

A mathematical model is presented for the description of axisymmetric laminar-jet diffusion flames. The analysis includes the effects of inertia, viscosity, diffusion, gravity and combustion. These mechanisms are coupled in a boundary layer type formulation and solutions are obtained by an explicit finite difference technique. A dimensional analysis shows that the maximum flame width radius, velocity and thermodynamic state characterize the flame structure. Comparisons with experimental data showed excellent agreement for normal gravity flames and fair agreement for steady state low Reynolds number zero gravity flames. Kinetics effects and radiation are shown to be the primary mechanisms responsible for this discrepancy. Additional factors are discussed including elipticity and transient effects.
Author

N72-23948# Committee on Science and Astronautics (U. S. House).
AN INVENTORY OF ENERGY RESEARCH, VOLUME 1
Washington GPO 1972 1110 p refs Presented to the Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., 20 Feb. 1972
Avail: Subcomm. on Sci, Res., and Develop.

Evaluated are the needs of the United States of America for research and development related to the generation, transmission and utilization of energy. Considered are: general fossile fuels, coal, petroleum, natural gas, nuclear, plasma, hydraulic, solar, geothermal, wind, wood and other biological, chemical, and unspecified energy sources. G.G.

N72-23949# Lockheed Missiles and Space Co., Palo Alto, Calif.
LOW FREQUENCY SELF-OSCILLATORY PROCESSES IN POWDER COMBUSTION
I. B. Svetlichnyi, A. D. Margolin, and P. F. Pokhill [1972] 8 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (Moscow), v. 7, no. 2, 1971 p 188-194
Avail: NTIS HC $3.00; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Low frequency self-oscillations in combustion originate under specific conditions in powder combustions in both a constant pressure bomb and in a semi-closed volume. By using various experimental methods, these processes were investigated in the combustion of pure H powder and with a 5.8% Al admixture. Test equipment and experimental results are described and discussed. Author

N72-23950# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
TABULATED HEAT TRANSFER RATE DATA FOR A HYPERSONIC TURBULENT BOUNDARY LAYER OVER A FLAT PLATE
G. T. Coleman Mar. 1972 35 p refs Sponsored by Min. of Aviation Supply
(IC-Aero-72-06) Avail: NTIS HC $3.75

An extensive study of the heat transfer rate to flat plates from compressible turbulent boundary layers has been carried out using the Imperial College No. 2 Gun Tunnel. This facility was specifically built to generate hypersonic high Reynolds number flows giving natural transition on a flat plate model at a Mach number of 9. The data obtained in the investigation usefully extends the range of existing data since above Mach 5 very little previously existed. This report is intended to make the large amount of data which has been collected available in tabulated form for any possible use in the testing of theoretical methods or in space vehicle design. Author

N72-23951*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FREQUENCY RESPONSE OF A VAPORIZATION PROCESS TO DISTORTED ACOUSTIC DISTURBANCES
Marcus F. Heidmann Washington May 1972 33 p refs
(NASA-TN-D-6806; E-6761) Avail: NTIS HC $3.00 CSCL 20M

The open-loop response properties expressed as the mass vaporized in phase and out of phase with the pressure oscillations were numerically evaluated for a vaporizing n-heptane droplet. The evaluation includes the frequency dependence introduced by periodic oscillation in droplet mass and temperature. A given response was achieved over a much broader range of frequency with harmonically distorted disturbances than with sinusoidal disturbances. The results infer that distortion increases the probability of incurring spontaneous and triggered instability in any rocket engine combustor by broadening the frequency range over which the vaporization process can support an instability. Author

N72-23952# Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.
NONLINEAR HEAT CONDUCTIONS IN RAREFIED GASES
Y. S. Lou and T. K. Shih 2 May 1972 31 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Sep. 1972
Avail: NTIS HC $3.75

Nonlinear problems of thermal conduction in monatomic rarefied gas confined within two concentric cylinders and spheres are studied by the four-moment method coupled with the bimodal twostream distribution function of Beck. The force interacting between gas molecules is assumed to obey Maxwell's inverse-fifthpower law. During the process of solving the four-moment equations, restriction on temperature difference between the two boundary surfaces has been removed. Results obtained are presumed to be complete solutions obtainable by the four-moment technique with the assumed velocity distribution for the gas. The present solution includes the boundary condition of incomplete thermal accomodation at the inner solid surface. Comparisons with results obtained by linear and other nonlinear theories have been made for the cases of several temperature differences, Knudsen numbers, radius ratios and accommodation coefficients. Author

N72-23953*# TRW Systems Group, Redondo Beach, Calif.
THEORY AND DESIGN OF VARIABLE CONDUCTANCE HEAT PIPES
B. D. Marcus Washington NASA Apr. 1972 248 p refs
(Contract NAS2-5503)
(NASA-CR-2018) Avail: NTIS HC $3.00 CSCL 20M

A comprehensive review and analysis of all aspects of heat pipe technology pertinent to the design of self-controlled, variable conductance devices for spacecraft thermal control is presented. Subjects considered include hydrostatics, hydrodynamics, heat transfer into and out of the pipe, fluid selection, materials compatibility and variable conductance control techniques. The report includes a selected bibliography of pertinent literature, analytical formulations of various models and theories describing variable conductance heat pipe behavior, and the results of numerous experiments on the steady state and transient performance of gas controlled variable conductance heat pipes. Also included is a discussion of VCHP design techniques. Author

N72-23954# Goodyear Atomic Corp., Piketon, Ohio.
INDUCTION MOTOR TEMPERATURE MONITORING BY THE MEASUREMENT OF MOTOR EXHAUST AIR TEMPERATURE
C. F. Harley 21 Jan. 1972 12 p ref
(Contract AT(33-2)-1)
(GAT-658) Avail: NTIS HC $3.00

Each induction motor used in a gaseous diffusion cascade has a life inversely proportional to its internal hot spot operating temperature. To ascertain these operating temperatures, in order to optimize motor life by timely motor cleaning, reliance previously had to be placed on data from a relatively few operating motors equipped with internal thermocouples at the time of their manufacture. To overcome reliance on such limited sample data, a method was developed for approximating internal hot spot temperature by measuring the motor exhaust air stream temperatures with thermocouples arranged in a portable matrix and inserted under the motor in the exhaust air stream. Over the normal operating range for the 2000 hp and 950 hp motors tested, a linear relationship prevails between the highest measured exhaust air stream temperature and the motor internal hot spot temperature. The internal hot spot temperatures for the 2000 hp and 950 hp induction motors can be determined with standard deviations of 8.8 F and 5.6 F, respectively. This method, with its error limitations, is a feasible technique for determining motor operating temperatures; thus the sequencing of motor cleaning can be based on a greatly expanded data base with a resultant improvement in motor life. Author

N72-23955# Brookhaven National Lab., Upton, N.Y.
THERMODYNAMICS OF A SOLVABLE MAGNETIC IMPURITY MODEL

A. Luther and V. J. Emery Jan. 1972 8 p refs Presented at 17th Ann. Conf. on Magnetism and Magnetic Mater., Chicago, 16-19 Nov. 1971
(BNL-16410; Conf-711108-12) Avail: NTIS

The temperature dependence of the susceptibility and specific heat for a proposed model of a magnetic impurity are computed. The model exhibits infrared singularities similar to those of the Kondo model, and provides a plausible description of the interaction between a magnetic impurity and conduction electrons in metals. The solution and results of the model Hamiltonian are discussed. F.O.S.

N72-23956# California Univ., Livermore. Lawrence Radiation Lab.
WAVE PROPAGATION MODEL FOR IMPULSE PREDICTION
Otis R. Walton 30 Jul. 1971 20 p refs
(Contract W-7405-eng-48)
(UCRL-51102) Avail: NTIS

Melt-dominated impulse produced by blowoff from a thin region of material that is instantaneously heated above melting may be estimated by considering propagation of the initial stress profile as an acoustic wave in a semi-infinite medium. The time integral of the stress profile as it passes some point is shown to be proportional to the total energy deposited. The constant of proportionality depends only on the depth of material melted and a simple initial shaped parameter for depositions near a free surface. If a material with a low relative shock impedance is placed over the heated region, the impulse is the same as for the free-surface case. If a material with a high relative shock impedance is placed over the heated region, the proportionality constant depends only on the relative shock impedance and is independent of melt depth and deposition shape. The model fails when the vapor pressure of the heated material becomes significant. Author (NSA)

N72-23957# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
POSTBURNOUT TRANSFER HEAT AND THERMODYNAMIC DISEQUILIBRIUM UP TO THE CRITICAL PRESSURE
M. Cumo, G. E. Farello, and G. Ferrari 4 Jan. 1971 22 p refs Presented at 4th Intern. Heat Transfer Conf., Paris-Versailles, 31 Aug. 1970
(RT/ING-(70)28; Conf-700805-5) Avail: AEC Depository Libraries

Experimental results are presented for the heat transfer coefficient in post-burnout conditions up to the critical pressure with Freon 12 flowing upward in tubular, uniformly heated ducts. The heat transfer coefficient and the degree of superheating were systematically tested against various leading parameters such as vapor quality, mass flowrate, and reduced pressure. The results are applicable to once-through heat exchangers, such as the steam generators in sodium-cooled fast reactor plants.
Author (NSA)

N72-23958# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.
SODIUM EDDY DIFFUSIVITY OF HEAT MEASUREMENTS IN A CIRCULAR DUCT
N. Sheriff and D. J. OKane [1970] 21 p refs
(NP-19040) Avail: AEC Depository Libraries

Measurements have been made of the eddy diffusivity of heat in a circular duct with turbulent sodium flow. The conventional method of making such measurements is to take temperature traverses across the fluid stream with a uniform heat flux at the duct wall. For measurements in the central region of the duct this method has several disadvantages, and in the present study a different technique has been used. The method used involves the injection of a point source of heat co-axially with the center line of the duct and temperature traverses downstream of the source. From the temperature measurements the total diffusivity is evaluated and hence the eddy contribution can be calculated. The development of the technique is described and values of total diffusivity measured at a Reynolds number of 8 x 10,000 are given in detail.
Author (NSA)

N72-23959# Sandia Labs., Albuquerque, N.Mex. Applied Mathematics Div.
TRANSIENT THERMAL WAVES IN THE GENERAL THEORY OF HEAT CONDUCTION WITH FINITE WAVE SPEEDS
Frederick Reyes Norwood Jan. 1972 21 p refs Sponsored by AEC
(SC-RR-720002) Avail: NTIS

The linear version of the general theory of heat conduction is employed to study the problem of a half-space subjected to step time inputs of temperature. The solution is obtained by the use of the Laplace transform on time and the sine transform on space. Exact solutions, wave front and long time approximations are obtained. The long time solutions satisfy the classical heat equation. It is shown that stable solution may be obtained under more relaxed conditions than those prescribed by the general theory. Author

N72-23960# Houston Univ., Tex. Dept. of Mechanical Engineering.
VAPOR EXPLOSION: HEAT TRANSFER AND FRAGMENTATION Technical Progress Report
L. C. Witte and J. E. Cox Jan. 1972 21 p refs
(Contract AT(40-1)-3936)
(ORO-3936-8) Avail: NTIS

Highly transient boiling from solid bodies, molten-jet/water interaction, and interaction of molten materials and liquids are studied. Both experimental and theoretical studies were performed. Results indicate that hot material must be completely molten for extensive fragmentation to occur; that fragmentation is a response to an external stimulus, probably the initial collapse of a vapor film; and that under some conditions the initial collapse of the vapor film is rapid enough to account for fragmentation.
Author

N72-23961# California Univ., Berkeley. Lawrence Radiation Lab.
HEAT CAPACITY OF IRON AS A FUNCTION OF PRESSURE AND TEMPERATURE Ph.D. Thesis
Albert Fan Yee Nov. 1971 82 p refs
(Contract W-7405-eng-48)
(LBL-180) Avail: NTIS

Constant current microsecond pulses are used to heat the sample and the temperature rise is calculated from the change in resistance. A constant current pulse generator is described. C sub P of iron was measured from 110 to 260 K and from 25 to 75 kbar. A slight decrease in C sub P with pressure was noted. The increase in Debye temperature was calculated to be 4.5K. A P-V isotherm was used to calculate the Gruneisen equation of state. Two gamma angular correlation distribution curves from positron annihilation in ytterbium metal were taken at nine different pressures that ranged from 1 atm to 80 kbar. There was special interest in the region of the fcc to bcc phase transition at 40 kbar. The observed increase in the widths of the measured curves with pressure could be entirely accounted for by the decrease in the volume of the metal with pressure.
Author (NSA)

N72-23962# Hittman Associates, Inc., Columbia, Md.
PIONEER THERMAL SWITCH EFFORT, JULY - NOVEMBER 1970 Final Report
Jan. 1971 47 p refs
(Contract AT(29-2)-2797)
(HIT-480) Avail: NTIS

Activities in a program to fabricate and test cylindrical sleeves suitable for use as the reentry protection shell for the Pioneer RTG heat source are reported. Three materials were developed and evaluated for this application. They include

copper/zirconia rigidized felt, copper/zirconia foam, and copper/magnesia foam. Most of the characterization effort was devoted to evaluation of the two zirconia-based materials. Results are included on sleeve fabrication, property determination, and materials selection. NSA

N72-23963# Institut Franco-Allemand de Recherches, St. Louis (France).
LIGHT EMISSION AND TEMPERATURE IN THE WAKE OF ABLATIVE POLYCARBONATE SPHERES WITH AND WITHOUT SODIUM TRACERS [LICHTEMISSION UND TEMPERATUR IM NACHLAUF VON ABLATIERENDEN POLYKARBONATKUGELN MIT UND OHNE NATRIUM-BESATZ]
H. Mach and A. Mueller 21 Jul. 1970 43 p refs In GERMAN (ISL-9/70) Avail: NTIS HC $4.25

Polycarbonate spheres were shot into air of from 5 to 20 torr with speeds of 4200 to 5800 m/s, and the flow in the wake visually investigated by means of light emitting ablation products. Inclusion of evaporating sodium in the projectiles improved and prolonged the visibility of the wake, which is shown quantitatively by spectral intensity measurements. A slight flow perturbation was caused by the sodium addition. The water temperature was determined spectroscopically from carbon particle emission and a modified Na inversion method. A further temperature measurement based on C2 vibration bands was also tried. Comparisons of light decay, duration, and threshold values are made for shots with and without additives. Author (ESRO)

N72-23964# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
MULTI-PURPOSE INSTRUMENT RESEARCH: A NEW MEASUREMENT TECHNIQUE AND PROPERTY TABLE GENERATION Final Report
Wolfgang Leidenfrost Oct. 1971 137 p refs
(Contract F44620-70-C-0070; AF Proj. 9750)
(AD-736870; WLRAF-8; AFOSR-71-3010TR) Avail: NTIS CSCL 07/4

Described is a Multi-purpose-Instrument which has demonstrated a new temperature-free technique to observe heat transfer and thermal transport properties by means of capacitance measurements. This technique is analyzed for a system of simple geometry. For a thick wall structure under programmed heat input capacitance-time curves are produced which depend on thermal conductivity only. Also described briefly are measurements on a test sample in gaseous and liquid state to observe: p-v-T, dielectric constant thermal conductivity, vapor pressure, saturation densities, thermal expansion coefficient, compressibility and specific heats. A computer program is developed to utilize p-v-T, dielectric and conductivity data to determine virial coefficients and values of intermolecular force parameters. Author (GRA)

N72-23965# Hercules, Inc., Magna, Utah. Bacchus Works.
VELOCITY COUPLING ANALYSIS Technical Report, 23 Aug. - 31 Dec. 1971
M. D. Horton, R. L. Coates, M. Krashin, and M. W. Beckstead Jan. 1972 59 p refs
(Contract F04611-72-C-0003)
(AD-737104; AFRPL-TR-72-12) Avail: NTIS CSCL 21/2

The report describes an analytical approach relating to the role of velocity coupled combustion response in solid propellant combustion instability. A study of the fundamental interaction between acoustic velocities and the propellant combustion indicate that a basic law relating the pressure and velocity dependence of combustion can most practically be assumed to be multiplicative. An analysis of velocity coupling acoustics in a T-burner indicate that both the Hart-McClure approach as refined by Coates and the Culick approach should be considered in reducing experimental data until the apparent controversy is resolved. Threshold velocity and flow reversal effects have been incorporated into an existing motor analysis; sample calculations indicate that an increased threshold velocity reduces the acoustic driving due to velocity coupling and that the effect of flow reversal is similar. Author (GRA)

N72-23966# Bureau of Mines, Pittsburgh, Pa. Mining and Safety Research Center.
IGNITION AND FIRE SUPPRESSION IN AEROSPACE VEHICLES Technical Report, 1 Jan. 1970 - 30 Nov. 1971
Joseph M. Kuchta, Ralph J. Cato, George H. Martindill, and Irving Spolan Wright-Patterson AFB, Ohio AFAPL Dec. 1971 49 p refs
(Contract F33615-69-M-5002; AF Proj. 3048)
(AD-737383; PMSRC-4164; AFAPL-TR-71-93) Avail: NTIS CSCL 13/12

Several halogenated hydrocarbons were evaluated as possible ignition or explosion suppressants for aircraft fuel tanks in which ignitions are initiated by incendiary ammunition. The inhibitors included Halons 2402 (C2F4Br2), 1301 (CF3Br), 1202 (CF2Br2), 1211 (CF2ClBr), and 1011 (CH2ClBr). Their effectiveness in retarding ignition or propagation of n-pentane-air mixtures was investigated with heated wires, exploding wires, and an incendiary composition. Large-scale experiments were conducted with Halon 1301 to determine its effectiveness and toxicity hazard in extinguishing Class A fires by the total flooding mode. A 6 percent Halon concentration was adequate for rapid extinguishment of cotton sheeting, paper sheeting, and nylon-paper sheeting fires. The toxic product formation varied with preburn time, combustible loading, and the extinguisher discharge mode. In addition, similar data are presented from small-scale experiments with Halon 38 (C3F8), which is less effective than Halon 1301 as an extinguishant. Author (GRA)

N72-23967# AeroChem Research Labs., Inc., Princeton, N.J.
ELECTRON ATTACHMENT AND COMPOUND FORMATION IN FLAMES. 5: NEGATIVE ION FORMATION IN FLAMES CONTAINING CHROMIUM AND POTASSIUM
William J. Miller Jan. 1972 24 p refs
(Contract N00014-71-C-0061)
(AD-736959; AeroChem-TP-275) Avail: NTIS CSCL 21/2

Application of several different experimental techniques (flame-ion mass spectrometry, microwave cavity resonance, electrostatic probe, and absorption spectrophotometry) reveals that addition of chromium to fuel-rich atmospheric-pressure H2/O2/N2 flames seeded with potassium results in formation of Cr-containing negative ions. A reaction scheme, equilibrium constants and enthalpy changes provide a satisfactory quantitative interpretation of the experimental results. Author (GRA)

N72-23790*# Boeing Co., Houston, Tex. Space Div.
CORRELATION OF APOLLO OXYGEN TANK THERMODYNAMIC PERFORMANCE PREDICTIONS
H. W. Patterson *In* NASA. Manned Spacecraft Center MSC Cryog. Symp. Papers May 1971 p 103-129 (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20M

N72-23798*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ZERO-GRAVITY TRANSIENT THERMAL MIXING SIMULATION
Jack F. Lands, Jr. and Robert C. Ried, Jr. *In its* MSC Cryog. Symp. Papers May 1971 p 407-432 (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20M

N72-23800*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FLAMMABILITY TESTING CONDUCTED IN SUPPORT OF APOLLO 13
L. J. Leger and R. W. Bricker *In its* MSC Cryog. Symp. Papers May 1971 p 455-474 refs (See N72-23785 14-27)
Avail: NTIS HC $27.75 CSCL 20M

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N72-23968* National Aeronautics and Space Administration, Washington, D.C.
USEFUL NEW TECHNOLOGY Technology Utilization Program
1971 17 p
(NASA-TM-X-67699) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 05B

An information booklet on the Technology Utilization program is presented. Industrial benefits, how to obtain technological data, special publications, Regional Dissemination Centers, multidisciplinary application teams, interagency activities, and patents and licenses are described briefly. N.E.N.

N72-23969*# Ultrasystems, Inc., Newport Beach, Calif.
AEROSPACE MANPOWER TRANSFER TO SMALL BUSINESS ENTERPRISES Final Report, Aug. 1971 - Mar. 1972
Malcolm K. Green Mar. 1972 111 p
(Contract NASw-2274)
(NASA-CR-126528; USI-CS-722) Avail: NTIS HC $7.75 CSCL 05C

The feasibility of a program to effect transfer of aerospace professional people from the ranks of the unemployed into gainful employment in the small business community was investigated. The effectiveness of accomplishing transfer of technology from the aerospace effort into the private sector through migration of people rather than products or hardware alone was also studied. Two basic methodologies were developed. One involves the matching of ex-aerospace professionals and small companies according to their mutual needs. A training and indoctrination program is aimed at familiarizing the professional with the small company environment, and a program of follow-up counseling is defined. The second methodology incorporates efforts to inform and arouse interest among the nonaerospace business community toward affirmative action programs that will serve mutual self-interests of the individuals, companies, and communities involved. Author

N72-23970# Naval Research Lab., Washington, D.C.
NRL PROGRESS REPORT, FEBRUARY 1972
Feb. 1972 48 p refs
Avail: NTIS HC $4.50

Research activities of the Naval Research Laboratory are presented. The principle subjects discussed are the effects of pollutants on the growth of algae and a laser flash technique for determining thermal diffusivity of liquid metals at elevated temperatures. Additional topics are presented in the fields of acoustics, metallurgy, ocean sciences, ocean technology, and radar. For individual titles, see N72-23971 through N72-23972.

N72-23971# Naval Research Lab., Washington, D.C. Marine Biology and Biochemistry Branch.
EFFECTS OF POLLUTANTS ON GROWTH OF ALGAE c04
P. J. Hannan and Constance Patouillet *In its* NRL Progr. Rept. Feb. 1972 p 1-8 refs (See N72-23970 14-34)
Avail: NTIS HC $4.50

The effects of a variety of pollutants on the growth rates of several freshwater and marine algae were investigated. Algae growth was determined by the increase in fluorescence of the test cultures, the pigment primarily responsible for this property being chlorophyll alpha. Of the pollutants tested, mercury was the most toxic. DDT was nontoxic unless added with appreciable amounts of solvent. Toxicity varied inversely with the concentrations of nutrients present, therefore any toxic effect should be described in the context of a given availability of nutrients. Author

N72-23972# Naval Research Lab., Washington, D.C. Metal Physics Branch.
A LASER FLASH TECHNIQUE FOR DETERMINING THERMAL DIFFUSIVITY OF LIQUID METALS AT ELEVATED TEMPERATURES c16
J. T. Schriempf *In its* NRL Progr. Rept. Feb. 1972 p 9-17 refs (See N72-23970 14-34)
Avail: NTIS HC $4.50

The use of the laser flash technique to measure the thermal diffusivity of liquid metals at elevated temperatures is discussed. It was determined that the accuracy of the results is sensitive to the degree of uniformity of the laser pulse. Appropriate optics inserted between the laser and the subject to obtain the desired pulse are described. The impact of the laser beam on the surface of mercury was photographically recorded. The test equipment used and the procedures for obtaining accurate results are reported. Author

N72-23973*# George Washington Univ., Washington, D.C.
SOCIAL IMPACTS OF CIVIL AVIATION AND IMPLICATIONS FOR R AND D POLICY Technical Report, Apr. 1970 - Apr. 1971
Louis H. Mayo Sep. 1971 223 p refs Sponsored jointly by DOT
(Contract NSR-09-010-069)
(NASA-CR-1988; DOT-TST-10-6) Avail: NTIS HC $3.00 CSCL 05K

An attempt was made to identify social impacts, both beneficial and detrimental, which would or could flow from the introduction of advanced civil aviation systems. A broad range of social impact areas was investigated which included economic, environmental, political, sociological, psychological, legal, and urban/regional developmental factors. Data are arranged into two major parts. In the first part, a series of Major Policy Issues are identified and discussed which appear, on the basis of the social impact study, to merit serious consideration. The discussion of each 'Issue' is presented both to explain its relevance and to raise considerations which will bear on its satisfactory resolution. The second part views the same overall body of information in a different manner: a series of 'Findings' are pointed out from which more concrete guidance for R and D policy can be derived, and a set of 'Candidate Basic Federal Undertakings' thus derived are presented. Author

N72-23974*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VEHICLE TECHNOLOGY FOR CIVIL AVIATION: THE SEVENTIES AND BEYOND Supplement: Panel Discussion
Washington 1972 25 p Conf. held at Langley Sta., Va., 2-4 Nov. 1971
(NASA-SP-292-Suppl) Avail: NTIS HC $3.00 CSCL 01E

The panel discussion on aviation technology for the seventies and beyond is reported. Topics discussed include: Government role in developing and applying new aeronautical technologies, noise and environmental problems, and congestion in the vicinity of major air terminals. F.O.S.

N72-23975*# Martin Marietta Corp., Denver, Colo.
METHODOLOGY FOR THE SYSTEMS ENGINEERING PROCESS. VOLUME 1: SYSTEM FUNCTIONAL ACTIVITIES Final Report
James H. Nelson Mar. 1972 140 p
(Contract NAS8-27567)
(NASA-CR-61380; MCR-71-352-Vol-1) Avail: NTIS HC $9.00 CSCL 05A

Systems engineering is examined in terms of functional activities that are performed in the conduct of a system

definition/design, and system development is described in a parametric analysis that combines functions, performance, and design variables. Emphasis is placed on identification of activities performed by design organizations, design specialty groups, as well as a central systems engineering organizational element. Identification of specific roles and responsibilities for doing functions, and monitoring and controlling activities within the system development operation are also emphasized. Author

N72-23976# Committee on Science and Astronautics (U. S. House).
NASA AUTHORIZATION, 1973, PART 4
Washington GPO 1972 431 p refs Hearings on H.R. 12824 (Superseded by H.R. 14070) before the Comm. on Sci. and Astronaut., 92d Congr., 2d Sess., No. 15, 17 Feb., 23-24 Feb., 29 Feb.-2 Mar. 1972
Avail: Subcomm. on Aeron. and Space Technol.

Minutes are presented for hearings on the 1973 NASA authorization before a Subcommitte on Aeronautics and Space Technology of the Unites States Congress. Considered are tracking data acquisition, technology utilization, related parts of construction of facilities, and research and program management. G.G.

N72-23977*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA CATALOG OF SATELLITE EXPERIMENTS
Dec. 1971 541 p
(NASA-TM-X-67707; NSSDC-71-20) Avail: NTIS HC $29.25 CSCL 22A

This catalog is divided into three sections: data description contains descriptions of data available at or through NSSDC as well as descriptions of the experiments and spacecraft from which the data originated; and supporting data contains brief descriptions of space environment models and programs distributed by NSSDC. Section 3 is a series of indexes that contain: (1) a listing of all spacecraft, experiment, and data descriptions presented in Section 1 plus tables indicating the period for which each spacecraft was operational; (2) an index of all spacecraft described here, identified by common names and alternate names; (3) a listing of the original experiment institutions for all experiments described; (4) a listing of the investigators associated with the experiments and their current affiliations; and (5) an index of all experiments sorted by phenomenon measured. Author

N72-23978# National Science Foundation, Washington, D.C. Government Studies Group.
SCIENCE RESOURCES STUDIES HIGHLIGHTS: FUNCTIONS OTHER THAN DEFENSE AND SPACE SHOW RISING SHARE IN FEDERAL R AND D EXPENDITURES
25 Apr. 1972 4 p
(NSF-72-305) Avail: NTIS HC $3.00 CSCL 05A

In the 1963-73 period the 10 budget functions other than national defense and space research and technology have registered an upward shift in R and D program emphasis. Until 1966 national defense and space research and technology represented 90 percent of the Federal R and D expenditure total. Since then the joint share of these two functions has decreased both relatively and absolutely to an expected 77 percent of the Federal R and D total in fiscal year 1973. The share of the other 10 functions has risen steadily, gaining 5 percentage points between 1970 and 1973 alone. Author

N72-23979# RAND Corp., Santa Monica, Calif.
THE EFFECT OF FUEL PRICE INCREASES ON ENERGY INTENSIVENESS OF FREIGHT TRANSPORT
W. E. Mooz Dec. 1971 55 p refs
(Grant NSF GS-31253)
(R-804-NSF) Avail: NTIS HC $4.75

The use of energy for transporting U.S. intercity freight and the effect of higher fuel price are analyzed. Methods of estimating unit energy consumption are developed and applied to determine average values and trends. Water transport is found to consume an average 500 BTU per ton/mile, rail 750, pipeline 1850, truck 2400, and air cargo 63,000, or 45 times the average for all transport modes in 1968. Only a small shift to air freight, from the present less than 0.2% to 2% of all intercity ton/miles, would double the average unit energy consumption for all freight modes. If present trends continue, this increase will occur by the year 1996. Because of its high fuel consumption, however, air freight growth would tend to be inhibited by higher fuel prices, while surface transport would be little affected. Higher fuel prices may result from shortages, the cost of environmental constraints, new taxes, or other reasons. Author

N72-23980# Federal Aviation Administration, Washington, D.C. Office of Systems Engineering Management.
ENGINEERING AND DEVELOPMENT PROGRAM: GOALS, ACHIEVEMENTS, TRENDS
31 Mar. 1972 179 p
Avail: NTIS HC $11.00

Engineering and development progress achieved during 1 April 1971 to 31 March 1972 is reported for FAA top management, DOT, FAA Services, Offices, Regions, Centers, and the aviation community. The emphasis is on the system, terminal tower control, runways/taxiways, aircraft safety, and support programs. Beacon, navigation, landing system, weather studies are described, and the radar, communication, oceanic, flow control, enroute control, flight service station, technology, satellite, environmental protection, and pilot warning indicator/collision avoidance system programs are also covered. N.E.N.

N72-23981*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ASEE-UNIVERSITY OF MARYLAND-CATHOLIC UNIVERSITY-NASA SUMMER FACULTY FELLOWSHIP PROGRAM Final Report, 15 Jun. - 12 Aug. 1970
J. C. Morakis, comp. 21 Aug. 1970 181 p refs
(NASA-TM-X-65866; X-752-71-277) Avail: NTIS HC $11.25 CSCL 20J

University faculty members go to Goddard for a period, often weeks, during which they engage actively in research and at the same time participate in seminars related to their research. The objectives of this program are: (1) stimulation of schools to become interested in the research problems confronting Goddard; (2) creation of interest of the university faculty to continue their research after completing the formal program; (3) stimulation of people through associations with the university faculty and through participation in the program's seminars; and (4) establishment of closer ties with the universities. Author

N72-23982*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A COMPILATION OF NONDIMENSIONAL NUMBERS
Norman S. Land Washington 1972 126 p refs
(NASA-SP-274) Avail: NTIS HC $3.00; SOD $0.70 CSCL 05B

The purpose of this compilation is to provide a ready means of identifying the named nondimensional numbers that are used in the various technical areas. The compilation probably contains most of the named nondimensional numbers that might be encountered. It also contains a few unnamed numbers that seem to be frequently used in certain fields. Author

N72-23983# Air Force Systems Command, Washington, D.C.
PROCEEDINGS OF THE AIR FORCE SYSTEMS COMMAND 1971 SCIENCE AND ENGINEERING SYMPOSIUM, VOLUME 1 Final Report
Arthur G. Wimer, Jr., (comp.) Dec. 1971 625 p refs Conf. held at Dayton, Ohio, 5-7 Oct. 1971 2 Vol.
(AD-736127; AFSC-TR-72-002-Vol-1) Avail: NTIS CSCL 14/2

The report is a compilation of papers presented at the Air Force Systems Command 1971 Science and Engineering Symposium held October 1971. The papers discuss topics

including air pollution control, gas chromatography, laser guidance, real time telemetry, radar elevation bias, doppler tracking receivers, hologram interferometry, electro-optical seeker systems, electromagnetic acceleration of gas, completely integrated reference instrumentation system (CIRIS), radiative modelling of the atmosphere, lightweight high energy battery, airdrop from cargo aircraft, intercell planar heat pipe, airfield foundations, vaporization of oxide scales, radiation effects in silicon semiconductors, interfacing problems on CCV performance. GRA

N72-23984# Air Force Systems Command, Washington, D.C.
PROCEEDINGS OF THE AIR FORCE SYSTEMS COMMAND 1971 SCIENCE AND ENGINEERING SYMPOSIUM, VOLUME 2 Final Report
Arthur G. Wimer, Jr., (Comp.) Dec. 1971 730 p refs Conf. held at Dayton, Ohio, 5-7 Oct. 1971 2 Vol.
(AD-736128; AFSC-TR-72-002-Vol-2) Avail: NTIS CSCL 14/2

The report is a compilation of papers presented at the Air Force Systems Command 1971 Science and Engineering Symposium held October 1971. The papers discuss topics including GETT simulation, video data reduction, mechanical impedance technique, high current pulse testing of microcircuits, holographic interferometry, crack propagation tests in the F-111, gyroscope centrifuge test, biodynamic model on spinal injuries from ejection seats, metal vapor lasers, discharge in gas lasers, thermostructural response of reentry nose tips, noise levels in aircraft, nematic liquid crystals, airborne fuze function indicators, short range attack missile (SRAM) navigation system, nonflammable fibrous materials, organophosphorus insecticide decontaminant, radar cloud/target polarization discrimination, shear-induced atmospheric turbulence, X-T Plotter for igloo white, military communications satellites, infrared image converters, the conus autovon, infrared imagery in environmental change, and effective maintenance data. GRA

N72-23985# Army Missile Command, Redstone Arsenal, Ala.
AN AUTOMATED DATA COLLECTION AND PROCESSING PROGRAM
David D. Tarkowski 15 Sep. 1971 44 p refs
(DA Proj. 11B-15011)
(AD-737194; RE-TR-71-6) Avail: NTIS CSCL 19/4

The report describes and explains the operating procedure of a digital program that controls an analog simulation of a missile-target intercept. The program automates the set-up of flight conditions, the collection of data from the simulation, and the calculation of the miss distance. Author (GRA)

N72-23986# Aeronautical Chart and Information Center, St. Louis, Mo.
ANALYSIS OF SOVIET AND WESTERN EUROPEAN GEODETIC SATELLITE DATA
Donald J. Wareham Dec. 1971 34 p refs
(AD-736831; ACIC-TR-72-4) Avail: NTIS CSCL 14/5

An investigation has been made of Soviet and Western European optical satellite data to determine its geodetic quality. Although the data was limited both in quantity and often in quality (not necessarily Soviet), it is noted how Soviet camera systems are capable of producing accurate geodetic station coordinates. GRA

N72-23987# ARO, Inc., Arnold Air Force Station, Tenn.
AN EXPERIMENTAL INVESTIGATION OF THE ROLL 1.5 AND AT ANGLES OF ATTACK UP TO 90 DEG Final Report
James C. Uselton AEDC Feb. 1972 14 p refs
(Contract F40600-72-C-0003; ARO Proj. VA0237)
(AD-737096; ARO-VKF-TR-71-219; AEDC-TR-72-3; AFATL-TR-72-4) Avail: NTIS CSCL 19/1

Free-spinning roll tests were conducted on a finned projectile model in the von Karman Facility (VKF) Supersonic Wind Tunnel (A). The tests were conducted at a Mach number of 1.50 and at a Reynolds number, based on model length, 2,200,000. Spin rate was obtained at angles of attack from 0 to 90 deg for fin cant angles of 0 and 2 deg. The zero cant angle fin configuration did not spin at any angle of attack. The spin rate for the 2-deg cant angle fin configuration decreased with angle of attack and had dual stable roll modes at some of the higher angles of attack. Author (GRA)

N72-23988# Aeronautical Chart and Information Center, St. Louis, Mo.
FREQUENCY ANALYSIS OF DISTURBANCES OF SUBMARINE VESSELS
L. A. Belobzeskii, A. M. Polikarpov, A. A. Savchenko, and V. A. Tulin Jan. 1972 21 p refs Transl. into ENGLISH from the publ. "Apparatura i Metody Izmereniya sily Tyazhesti na More' Moscow, Nauka, 1970 p 40-49
(AD-737106; ACIC-TC-1779) Avail: NTIS CSCL 17/6

A method is described of finding the spectral characteristics of a marine gravimeter signal with photo recording by the use of an analog computer. The accuracy estimation of calculations with the use of the indicated analog and digital computers is presented. It is shown that the main period of disturbing accelerations is found in the area of 250 sec. Author (GRA)

N72-23989# Defense Documentation Center, Alexandria, Va.
HYDROFOILS Report Bibliography, Jan. 1963 - Feb. 1971
Feb. 1972 268 p refs
(AD-737300; DDC-TAS-71-60-1) Avail: NTIS CSCL 13/10

The bibliography consists of references to unclassified and unlimited reports which were processed into the AD data bank from January 1963 through June 1971. These citations are based on theoretical studies and on actual and experimental conditions as applied to hydrofoils. Corporate author-monitoring agency, subject, title, personal author, contract, and report number indexes are included. Author (GRA)

N72-23990# National Bureau of Standards, Washington, D.C.
THE SOCIAL IMPACT OF NOISE
31 Dec. 1971 28 p refs Sponsored by Environmental Protection Agency
(PB-206724; EPA-NTID300.11; NTID300.11) Avail: NTIS HC $3.00 CSCL 05K

The World Health Organization defines health as a state of physical, mental, and social well being and not merely the absence of disease or infirmity. Using this definition it is evident that noise can be considered as having an important influence on the health of man. Because of its pervasive influence in all settings, activities and walks of life it is often cited as a major source of annoyance as well as a threat to physical and mental health. For most people the usual consequences of noise are associated with interference with listening to speech or other sounds, distraction at home and on the job, disturbance of rest and sleep, and disruption of recreational pursuits. In dealing with the social impact of noise, this report is divided into several sections: Overview; Extent of problem--changing scope of problem; Effects of noise--medical, psychological, social. GRA

N72-23068*# Research Triangle Inst., Durham, N.C.
INTERDISCIPLINARY BARRIERS: AN IMPEDIMENT TO THE EFFECTIVE APPLICATION OF SYSTEMS ENGINEERING
Ernest Harrison, Jr. *In its* Appl. of Aerospace Tech. in Biol. and Med. Dec. 1971 29 p refs Presented at 1971 Ann. Conf. of the Am. Occupational Therapy Assoc., Cleveland, 1 Nov. 1971 (See N72-23065 14-04)
Avail: NTIS HC $7.50 CSCL 05B

N72-23547# Joint Publications Research Service, Washington, D.C.
SEVERAL PROBLEMS IN ECONOMIC REFORM AT NONFERROUS METALLURGICAL ENTERPRISES
A. K. Doyev and I. A. Biryukov *In its* Bull. of the Inst. of Higher Learning, Nonferrous Met. 4 May 1972 p 153-158 (See N72-23539 14-17)
Avail: NTIS HC $4.75

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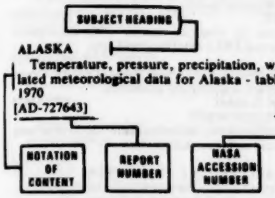

The subject heading is a key to the subject content of the document. The Notation of Content (NOC), rather than the title of the document, is used to provide a more exact description of the subject matter. The report number helps to indicate the type of document cited (e.g., NASA report, translation, NASA contractor report). The NASA accession number denotes the number by which the citation is identified. The NOC's are arranged under each subject heading in ascending accession number order.

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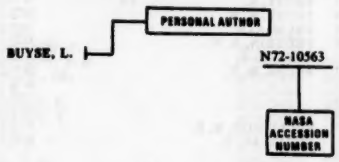

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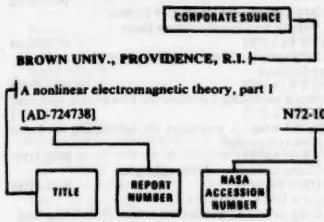

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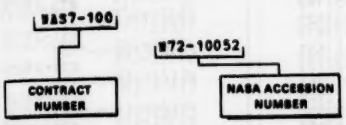

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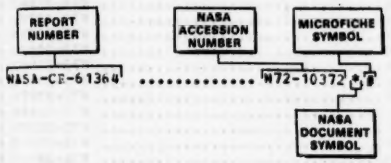

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The spacecraft carried seven scientific experiments: the ultraviolet photometer to measure the properties of the uppermost layers of the atmosphere; the solar plasma probe, the helium magnetometer, and the trapped-radiation detector to measure interrelated phenomena concerning the interaction of the planet with its environment; the S-band occultation and dual-frequency radio propagation experiments to probe the properties of the Venusian atmosphere; and the celestial mechanics experiment to measure the mass of Venus and the shape of its gravitational field. All experiments except S-band radio occultation acquired data. *Paperbound.* 312 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $3.00.

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